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QUALITY ASSURANCE PROJECT PLAN

301(H) WAIVER AND NPDES PERMIT RENEWAL APPLICATION SUPPLEMENT FOR ASPLUND WATER POLLUTION CONTROL FACILITY

Jacobs Engineering Group

Kinnetic Environmental Inc.

August 2022

DRAFT

Quality Assurance Project Plan, 301(h) Waiver and NPDES Permit Renewal Application Supplement, for Asplund Water Pollution Control Facility

Prepared for

Anchorage
Water and Wastewater Utility

August 2022

Jacobs

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Contents

Appendixes

Tables

Figures

Acronyms and Abbreviations

°C	degrees Celsius
µg/kg	micrograms per kilograms
µg/L	microgram per liter
ADCP	Acoustic Doppler Current Profiler
ADEC	Alaska Department of Environmental Conservation
ASTM	American Society of Testing and Materials
AWPCF	Asplund Water Pollution Control Facility
AWWU	Anchorage Water and Wastewater Utility
BIP	balanced indigenous population
CAS	Chemical Abstracts Service Registry Number
CFR	Code of Federal Regulations
COC	Chain-of-Custody
DGPS	differential global positioning system
DQO	Data Quality Objective
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
FTL	Field Team Leader
g	grams
HDPE	high-density polyethylene
JBER	Joint Base Elmendorf-Richardson
KEI	Kinnetic Environmental Inc.
KLI	Kinnetic Laboratory Inc.
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MBES	Multibeam Echosounder
MDL	method detection limit
mg/kg	milligrams per kilograms
mg/L	milligrams per liter
mgd	million gallons per day
ml	milliliter
ml/L	milliliter per liter
mm	millimeter
MS/MSD	matrix spike/matrix spike duplicate
N/A	not applicable
ng/kg	nanograms per kilogram
NPDES	National Pollutant Discharge Elimination System
OC	organochlorine
OP	organophosphate
oz	ounce
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCBs	polychlorinated biphenyls
PM	project manager
ppt	parts per thousand

QA	quality assurance
QA/QC	quality assurance/quality control
QA/QCM	QA/QC manager
QAM	quality assurance manual
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	quality control
RPD	relative percent difference
SOP	Standard Operating Procedures
SRM	Standard Reference Materials
SSWQC	Site Specific Water Quality Criteria
STP	sample tracking program
SVOCs	semivolatile organic compounds
TBD	to be determined
TOC	total organic carbon
TVS	total volatile solids
USACE	U.S. Army Corps of Engineers
VOCs	volatile organic compounds
WAAS	Wide Area Augmentation System
WET	Whole Effluent Toxicity
ZID	Zone of Initial Dilution

Distribution List for the Asplund WPCF 301(h) Waiver Renewal Application Supplement QAPP

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1. Introduction

1.1 Background

The Anchorage Water and Wastewater Utility (AWWU) owns and operates the Asplund Water Pollution Control Facility (AWPCF). The AWPCF serves the Anchorage area and is located at Point Woronzof (Figure 1-1). Plant influent is primarily of domestic origin, although a limited industrial component is included, and the Municipality of Anchorage has local limits for pretreatment and a monitoring program for significant industrial users. There are no combined sewers in the Anchorage sewer system. The existing facility provides treatment for a design average flow of 58 million gallons per day (mgd) and a maximum hourly flow of 154 mgd. The annual average daily discharge is approximately 28 mgd.

Existing treatment units provide screening, grit removal, sedimentation, skimming, and chlorination. The treatment process results in removal rates that are much higher than typical primary treatment facilities, . Sludge from the primary clarifiers is thickened and dewatered. The dewatered sludge and skimmed materials are incinerated, and the ash disposed of in a sanitary landfill.

The AWPCF discharges chlorinated primary effluent through a 120-inch-diameter chlorine contact tunnel leading to an 84-inch-diameter outfall located north of Point Woronzof that terminates in a multi-port diffuser in the Knik Arm of Cook Inlet (Figure 1-1).

The AWPCF is operated by AWWU under National Pollutant Discharge Elimination System (NPDES) Permit No. AK-002255-1 with a waiver from secondary treatment for total suspended solids, biochemical oxygen demand,fecal coliform, and TRC —as issued by U.S. Environmental Protection Agency (EPA) Region 10 in 2000. Section 301(h) of the Clean Water Act defines conditions under which the EPA Administrator may grant waivers from secondary treatment standards. One of the conditions of Section 301(h) is the development and implementation of a program to monitor the impact of the approved discharge on the receiving water and the marine biota. Since 1986, AWWU has implemented an extensive monitoring program as approved in the NPDES permit.

The Point Woronzof outfall extends 804 feet from the shore at Point Woronzof and terminates with a trifurcated turret diffuser. The discharge depth of the diffuser during a typical 24-hour tidal cycle ranges from 12 feet to 41 feet. The outfall diffuser has an NPDES-permit-defined zone of initial dilution (ZID) with a radius of 650 meters from a point 30 meters inshore of the terminus. The ZID is the region provided for immediate mixing and dilution of the wastewater (Figure 1-2). Current speeds at the discharge site range from approximately 1 to 6 knots during the ebb and flood tidal exchanges.

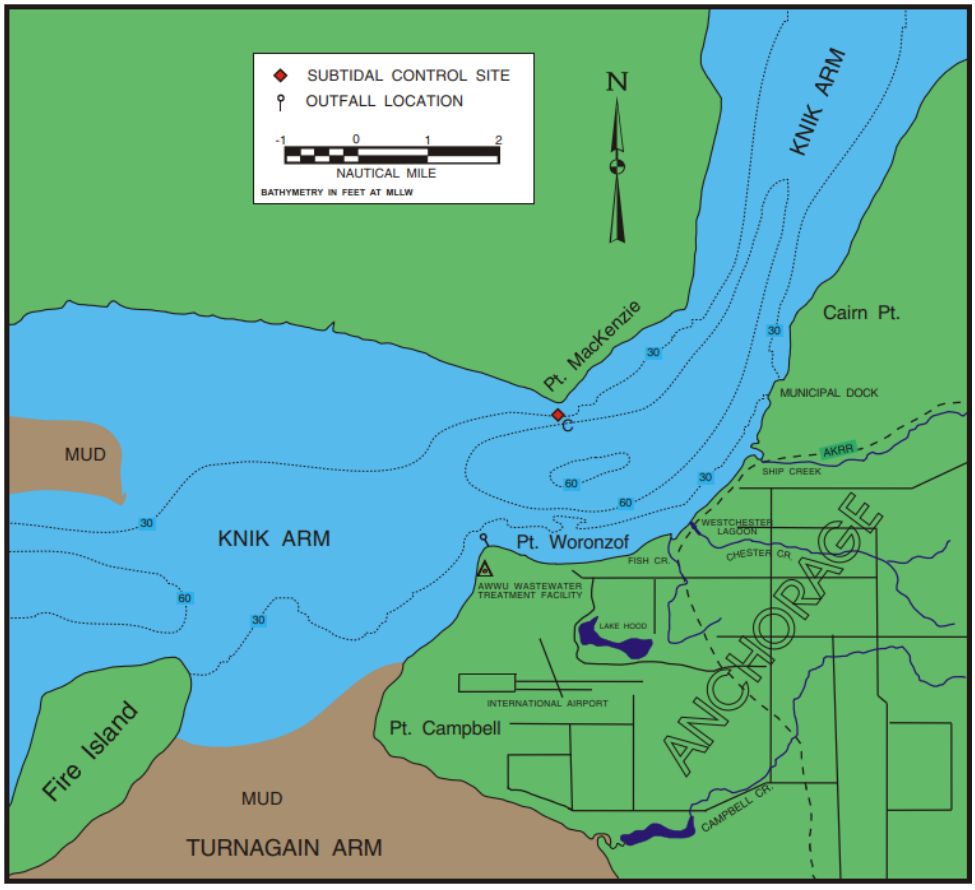


Figure 1-1. AWPCF and Outfall at Point Woronzof in Knik Arm of Cook Inlet

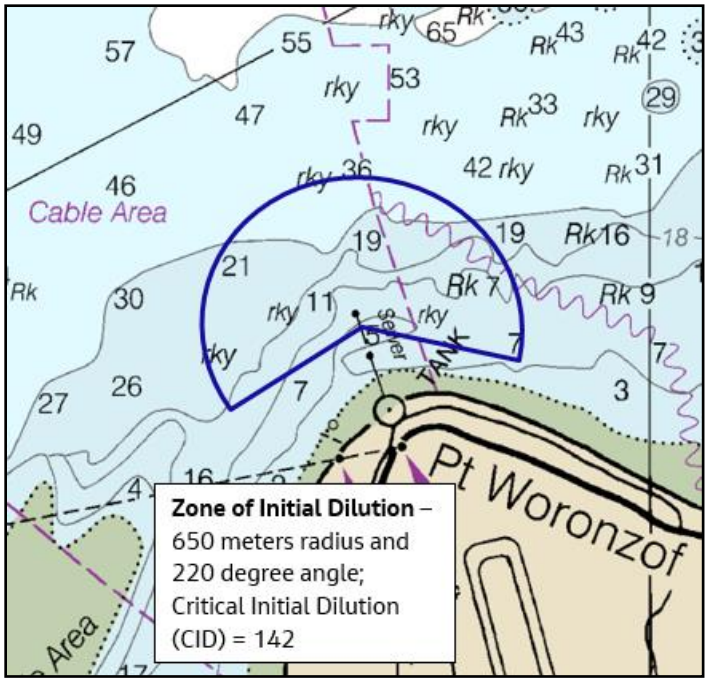


Figure 1-2. AWPCF, Outfall at Point Woronzof, and ZID in Knik Arm (on NOAA Chart)

As part of renewal application for the NPDES permit in 1999 (CH2M HILL, 1998), AWWU also submitted an application for Site Specific Water Quality Criteria (SSWQC) to the Alaska Department of Environmental Conservation (ADEC) for a limited area of the Upper Cook Inlet in the vicinity of Point Woronzof

(CH2M HILL, 1999). The justification for incorporating SSWQC for the Point Woronzof area into the Alaska State Water Quality Standards included the following key elements:

- High ambient turbidity and non-dissolved metals concentrations in Knik Arm of Cook Inlet result from upstream watershed processes that result in high natural levels of turbidity and non-bioavailable metals fractions.
- The SSWQC use the natural levels of turbidity and EPA's metals policy of applying only the dissolved metals fraction as potentially bioavailable and appropriate for the protection of aquatic life, human health, and beneficial uses in the waters.

The SSWQC were deemed appropriate and were approved by EPA, ADEC, and the National Marine Fisheries Service because the natural background concentrations of non-dissolved metals (non-bioavailable) and turbidity in Cook Inlet were higher than the non-dissolved metals-based criteria and turbidity standards that were in effect in the Alaska Water Quality Standards in 1999. The SSWQC for acute and chronic chemical criteria (dissolved metals and turbidity criteria) for the Point Woronzof area were incorporated into Alaska Water Quality Standards, 18 Alaska Administrative Code 70.236(b)(4).

EPA's reissuance of the AWPCF NPDES permit and EPA's approval of the SSWQC required EPA to prepare a Biological Evaluation to assess potential effects on threatened or endangered species. This Biological Evaluation (EPA, 2000) concluded that reissuance of the NPDES permit and approval of the site-specific criteria for upper Cook Inlet would not adversely affect beluga whales. The EPA also prepared an Essential Fish Habitat (EFH) Assessment (EPA, 2000), in accordance with the Magnuson-Stevens Fishery Conservation and Management Act This EFH concluded that reissuance of the NPDES permit and approval of the site-specific criteria for upper Cook Inlet would not adversely affect EFH in the region. In a June 2000 letter to EPA, the National Marine Fisheries Service concurred with both EPA's Biological Evaluation and EFH Assessment conclusions (National Oceanic and Atmospheric Administration [NOAA], 2000).

Since approval of the SSWQC for the Point Woronzof area in 2000, the Alaska Water Quality Standards were revised to apply a dissolved metals basis for compliance evaluations and EPA approved ADEC's use of dissolved metals for the State's marine water quality criteria. all of the dissolved metals acute and chronic criteria in the current NPDES permit are the same as those listed in the SSWQC, except for cadmium (dissolved standard of 9.3 micrograms per liter (µg/L), which was changed to 8.8 µg/L in latest marine water quality criteria [2008]), and mercury (dissolved standard of 0.025 ug/L, which was changed to 0.94 µg/L in latest marine water quality criteria [2008]).

In January 2005, AWWU applied to the EPA for renewal of the NPDES permit and 301(h) waiver (CH2M HILL, 2004). During the preparation of these permit renewal documents, AWWU worked closely with EPA and ADEC staff to address all potential environmental concerns. In the development of the permit renewal applications, a comprehensive review of the physical environment, water quality, biological community and habitat, and protected beneficial uses of the water body in the affected region was completed. No impacts have been measured from the existing discharge, as documented in extensive monitoring since 1986 and the analyses developed for the permit renewal applications.

1.2 301(h) Waiver Criteria

Section 301(h) of the Clean Water Act sets out the following criteria for waivers from secondary treatment:

1. There is an applicable water quality standard specific to the pollutant for which the modification is requested, which has been identified under Section 304(a)(6) of the Act.
2. The discharge of pollutants in accordance with such modified requirements will not interfere, alone or in combination, with pollutants from other sources, with the attainment or maintenance of that water quality that ensures protection of public water supplies and protection and propagation of a balanced indigenous population (BIP) of shellfish, fish, and wildlife, and allows recreational activities in, and on, the water.

3. The applicant has established a system for monitoring the impact of such discharge on a representative sampling of aquatic biota, to the extent practicable, and the scope of such monitoring is limited to include only those scientific investigations that are necessary to study the effects of the proposed discharge.
4. Such modified requirements will not result in any additional requirements on any other point or nonpoint source.
5. All applicable pretreatment requirements for sources introducing waste into such treatment works will be enforced.
6. In the case of any treatment works serving a population of 50,000 or more, with respect to any toxic pollutant introduced into such works by an industrial discharger for which there is no applicable pretreatment requirement in effect, sources introducing wastes into such works are in compliance with all applicable pretreatment requirements, the applicant will enforce such requirements, and the applicant has in effect a pretreatment program that, in combination with the treatment of discharges from such works, removes the same amount of such pollutant as would be removed if such works were to apply secondary treatment to discharges and if such works had no pretreatment program with respect to such pollutant.
7. To the extent practicable, the applicant has established a schedule of activities designed to eliminate the entrance of toxic pollutants from non-industrial sources into such treatment works.
8. There will be no new or substantially increased discharges from the point source of the pollutant to which the modification applies above that volume of discharge specified in the permit.
9. The applicant, at the time such modification becomes effective, will be discharging effluent that has received at least primary or equivalent treatment, and that meets the criteria established under Section 304(a)(1) of the Clean Water Act after initial mixing in the waters surrounding or adjacent to the point at which such effluent is discharged.

This document focuses on Criteria 2 and 3 of the preceding list. Specifically, pursuant to 40 *Code of Federal Regulations* (CFR) §125.62 and §125.63, the goals of the enclosed sampling and analysis protocols are as follows:

- Document short- and long-term effects of the discharge on the receiving waters, sediments, biota, and on beneficial uses of the receiving water.
- Determine compliance with NPDES permit terms and conditions, and state and federal water quality standards/criteria.
- Assess the effectiveness of toxic control programs.

1.3 Existing NPDES Monitoring Program Elements

As required by its NPDES permit, AWWU has conducted extensive monitoring of the AWPCF influent and effluent, as well as monitoring in Knik Arm of Cook Inlet since 1986. In addition to monitoring processes within the treatment plant, the monitoring program includes receiving water quality monitoring and biological and sediment monitoring.

The monitoring program as described by NPDES Permit No. AK-002255-1 includes plant influent/effluent sampling, sewage sludge management procedures, water quality monitoring, biological and toxicological monitoring, and a toxics control program. The objectives of the existing NPDES monitoring program are as follows:

- Determine compliance with the NPDES permit.
- Determine compliance with Alaska State Water Quality Standards.
- Determine effectiveness of the industrial pretreatment program.

- Assess the water quality at the discharge point.
- Characterize toxic substances in the AWPCF effluent.
- Monitor the AWPCF performance.
- Determine compliance with Section 301(h) of the Clean Water Act.
- Determine the level of bacterial concentrations in nearshore waters.
- Monitor for changes in sediment quality near Point Woronzof.
- Evaluate whether discharge constituents could accumulate in exposed biological organisms.
- Provide data for evaluations during permit renewal and reissuance.

The elements of the existing monitoring program for the AWPCF include the following:

- Influent, effluent, and sludge monitoring:
  - In-plant sampling
  - Toxic pollutants (priority pollutants) – two per year
  - Metals and cyanide – six per year
  - Pretreatment monitoring – two per year
  - Whole Effluent Toxicity (WET) testing – quarterly
- Receiving water quality monitoring
  - Ambient water quality sampling and field measurements – one per year
  - Plume dispersion measurements – one per year
  - Intertidal bacteria sampling – one per year
- Sediment and biological monitoring
  - Sediment sampling and testing – once (2003)
  - Benthic biota sampling and testing – twice (1989)
  - Bioaccumulation studies – once (2004)

The monitoring program is administered by AWWU. The sampling and analyses are conducted by Kinnetic Environmental Inc. (KEI) with support from numerous laboratories. State-of-the-art equipment and laboratory sampling and analysis methods are used to ensure the best possible detection (i.e., metals are analyzed by methods developed by Battelle Northwest that achieve levels of detection much lower than those required by EPA). Annual monitoring program reports are produced by AWWU and submitted to EPA in accordance with the permit requirements (Kinnetics Laboratories Inc. (KLI) 1987a, 1987b, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, and 2021).

The existing monitoring program for the AWPCF 301(h) waiver has been conducted in accordance with the existing Monitoring Program Workplan and Quality Assurance Project Plan for the AWPCF NPDES permit and 301(h) waiver (KLI, 2012); and the Laboratory Services Quality Assurance/Quality Control Plan for Anchorage Water & Wastewater Utility, Treatment Division, Water Quality Section, Asplund Laboratory. Alaska Laboratory #AK00017 (AWWU, 2022).

This Quality Assurance Project Plan (QAPP) does not replace the existing QAPP for the AWPCF NPDES permit and 301(h) waiver; rather, it is designed to develop supplemental data collections to support the AWWU NPDES and 301(h) waiver renewal application supplement for use by EPA, ADEC, and other agencies in the technical review of the waiver renewal application.

1.4 New Data Collection Program Data Tiers

A key data collection program objective is to produce focused and reliable scientific data that satisfy 301(h) waiver permit renewal requirements defined in the Amended Section 301(h) Technical Support Document (EPA, 1994c) to address specific technical questions in the 301(h) Large Applicant Questionnaire. The new data collection program is designed specifically to perform data collections to supplement the existing NPDES monitoring program, fill in data gaps, and obtain data that have not been updated in recent years. The new data collection program is focused on scientific investigations necessary to study and document effects, or absence of effects, of the AWPCF discharge to Knik Arm. This QAPP focuses on protocols that directly relate to determining whether the discharge has, or will have, any significant impacts on the receiving water quality, sediment quality, and/or biota.

The elements of the new data collection program have been organized into four tiers for data collection and interpretation:

- The first tier is needed to directly address compliance with water quality standards (e.g., influent, effluent, and receiving water quality). Data generated by these elements will be used to evaluate pretreatment influent sources and effects on WET tests as well as effluent compliance with the numeric water quality criteria.
- The second tier addresses the most likely indicators of cause and effect responses of the biota to the effluent discharge. The EPA 301(h) guidance documents indicate that benthic invertebrate communities are the biological communities most likely to reflect the effects of publicly-owned treatment works discharges to the marine environment. The link between these communities and effluent quality is provided by suspended solids loads and any associated particulate-associated chemical pollutants (e.g., metals or organics). Sampling of benthic invertebrate communities, coupled with physical and chemical screening of the sediments at sampling stations within the ZID and at comparable reference sites, is an important tool used to evaluate potential discharge effects on the marine environment.
- Because bottom-feeding fishes are directly dependent on benthic invertebrate communities, sampling demersal fishes and their muscle tissue (to assess potential for bioaccumulation) is the third prioritized data collection tier.
- The fourth tier provides important physical data to supplement the other three tiers of information. It will include bathymetry and surficial habitat survey of the ZID region, as well as site-specific current measurements in the ZID.

1.5 New Data Collection Program Elements and Objectives

A fundamental objective of the new data collection program is to produce focused scientific studies that yield relevant and reliable data for EPA decision making. These data are needed to support the overall 301(h) waiver evaluation goals, including effluent and receiving water documentation and analyses in accordance with the EPA 301(h) guidance documents. The objectives of this program include the following items:

- Measure and document the protection of a BIP of biotic communities in Knik Arm.
- Assess the effectiveness of the pretreatment program and effluent toxicity controls.
- Assess the benthic marine habitat and physical environment in the ZID.
- Assess potential effects on recreational activities.

The elements of the new data collections program for the AWPCF include the following:

- Pretreatment source sampling and testing:
  - Pretreatment leachate sampling, chemical analyses, and WET testing
- Receiving water quality monitoring:

  - Ambient water quality sampling and analyses for priority pollutants
- Physical data collections:
  - Current measurements in the ZID
  - Bathymetry and surficial habitat type survey in ZID region
- Sediment and biological sampling and analyses:
  - Sediment sampling and testing in ZID and reference site
  - Benthic biota sampling and testing in ZID and reference site
  - Fish Community and tissue sampling and testing in ZID and reference site

These new data collections will conform to EPA-approved sampling and analytical procedures. This QAPP summarizes the field and analytical methods that will be applied by the AWWU technical project team in executing the new data collection program for the AWPCF 301(h) waiver and NPDES renewal application supplement.

2. Project Organization and Schedule

2.1 Project Organization

Parties involved in the project organization include personnel from AWWU, Jacobs Engineering Group Inc. (Jacobs), KEI, and other subcontractors for field and laboratory services. The AWWU contractors are collectively referred to in this document as the Contract Project Team. The project organization is defined below and listed in Table 2-1. Laboratory services providers are listed below.

The AWWU Project Manager, Mr. Tom Winkler, is responsible for overseeing execution of the project.

The Contract Project Team Project Manager (PM), Ms. Amanda McGinnis, is responsible for managing the project team and program activities in accordance with the QAPP. Issues and decisions related to work scope, progress, quality, schedules, and budget are subject to the direction, review, and approval of the PM. The PM arranges for resolution and implementation of review comments and corrective actions, and is the primary link with AWWU in deciding project scopes, schedules, and budgets.

The Studies Manager, Mr. David Wilson, is responsible for overseeing day-to-day project activities, tracking project budget and schedule, and project deliverables. Mr. Wilson will also assist the PM with developing presentations to support discussions with the regulatory agencies.

Mr. Mark Savoie is the Field Program Manager and Quality Assurance/Quality Control Manager (QA/QCM). He will ensure that proper QA/QC (Quality Assurance/Quality Control) procedures are adhered to throughout the project. The QA/QCM ensures that quality control reviews are performed and documented in written form, and that QA/QC records are generated and stored in accordance with project plans and procedures. The QA/QCM has the authority and organizational latitude to do the following:

- Identify quality problems.
- Initiate, recommend, or provide corrective actions for quality problems through designated channels.
- Verify implementation of corrective actions.

As the Field Program Manager, Mr. Savoie will be responsible for execution of the field sampling activities, which includes contacting the analytical laboratories to confirm that samples arrive properly prepared, packaged, and identified. He will contact the Studies Manager before sampling to verify that personnel assigned to field sampling teams are adequately trained in sample collection procedures, chain-of-custody (COC) procedures, and health and safety procedures.

Under the guidance of the Field Program Manager and the Studies Manager, Jacobs and KEI scientific and engineering staff will conduct the analysis of data generated by this data collection program using appropriate statistical data analysis methods. Physical oceanography support will be led by Dr. Steve Costa.

Ms. Lindsey Smoot will be responsible for creating and maintaining a project database and coordinating the electronic transfer of laboratory data.

Field sampling health and safety issues for the project will be directed by Mr. Michael Sinon. Mr. Sinon will develop the field sampling health and safety plan for the project. Under his direction, the Field Program Manager oversees the administration of the project health and safety plans in the field and assists in conducting safety briefings. The Field Program Manager is responsible for stopping any investigation-related operation that threatens the health and/or safety of the field team.

Participating laboratories and subcontractors on the project team include the following:

- Analytical Chemistry:
  - ASL Laboratory
- Benthic Infauna Taxonomy :

  - EcoAnalysts
  - KEI
- Fish Taxonomy:
  - KEI
- WET Testing:
  - Pacific EcoRisk

2.2 Project Responsibilities

Responsibilities of key project personnel and organizations are shown on the responsibility matrix presented in Table 2-1.

Table 2-1. Project Responsibilities Matrix

QAPP for the AWPCF 301(h) Waiver and NPDES Permit Renewal Data Collections

Position	Personnel	Organization/Contact	Responsibilities
AWWU Project Manager	Tom Winkler	AWWU Anchorage, AK Tom.Winkler@awwu.biz (907) 720-6922	Primary client contact; contact for site access and information
Contract Team Project Manager	Amanda McInnis	Jacobs Missoula, MT Amanda.Mcinnis@jacobs.com (406) 546-4806	Program administration: oversees project activities and tracks project budget and schedules
Studies Manager	David Wilson	Jacobs Bellevue, WA David.Wilson@jacobs.com (425) 985-8762	Coordinates project activities and leads quality control reviews
Field Program Manager and QA/QC Manager	Mark Savoie	KEI Anchorage, AK MSavoie@kinneticenv.com (907) 229-3365 Mobile (907) 276-6178 Office	Schedules and manages execution of field activities, and coordinates laboratory services
Technical Advisor	Don Holmes	Jacobs Sedgewick, MA Don.Holmes@jacobs.com (207) 409-7186	Performs technical review of analytical data, results, and project deliverables
Data Manager	Lindsey Smoot	Jacobs Boise, ID Lindsey.Smoot@jacobs.com (208) 241-5228	Manages coordination of the database
Health and Safety Officer	Michael Sinon	Jacobs Bellevue, WA Michael.Sinon@jacobs.com (406) 559-0891	Prepares project health and safety plan for field activities

Table 2-1. Project Responsibilities Matrix

QAPP for the AWPCF 301(h) Waiver and NPDES Permit Renewal Data Collections

Position	Personnel	Organization/Contact	Responsibilities
Report Publications	John Hall	Jacobs Portland, OR John.Hall@jacobs.com (503) 235-5022	Edits and coordinates production of project deliverables

2.3 Project Schedule

Table 2-2 shows the proposed project schedule for 2022 data collections, laboratory analyses, and data evaluations. These 2022 data collections will be evaluated and developed for use in the NPDES and 301(h) waiver renewal application supplement. AWWU will be communicate with EPA and ADEC to inform of the progress of sampling, laboratory analyses, and data evaluation activities.

Table 2-2. Project Schedule Overview

QAPP for the AWPCF 301(h) Waiver and NPDES Permit Renewal Data Collections

	2022 Data Collections, Analyses, and Evaluations				
	Aug.	Sept.	Oct.	Nov.	Dec.
Physical Assessment					
Bathymetry and Habitat Survey	D	A	R		
Current Measurements		D	D/A	R	
Chemical Assessment					
Pretreatment Leachate and JBER Toxicity Testing	D	A	A	R	
Receiving Water Priority Pollutants	A*	R*			
Marine Sediments	D	A	A	R	
Biological Assessment					
Benthic Infauna Community	D	A	A	A	R
Fish Community and Tissue	D	A	A	A	R

* Receiving water priority pollutant samples were collected during the annual receiving water monitoring event in June 2022 and have been submitted for chemical analyses.

JBER = Joint Base Elmendorf-Richardson.

D = data collections; A = laboratory and other analyses; and R = reporting of results.

3. Field Procedures and Data Evaluation

3.1 Pretreatment Leachate and Joint Base Elmendorf-Richardson Toxicity Testing

3.1.1 Monitoring Objectives

The existing AWPCF NPDES monitoring program requires whole effluent toxicity (WET) testing of final effluent on a quarterly basis. Some measurable toxicity is typically seen during each of these monitoring efforts with the most sensitive tests and species; i.e., the chronic echinoderm fertilization test utilizing the purple urchin (*Strongylocentrotus purpuratus*).

The purpose of this supplemental testing element is to perform the same toxicity testing on six specific inputs to Anchorage's wastewater system to determine if any of these six influent sources account for a measurable portion of the toxicity found in the AWPCF effluent discharge. The source inputs to the wastewater system that will be examined include leachate from the Anchorage Regional Landfill, Merrill Field Landfill, and the Matanuska-Susitna (Matsu) Borough's Central Landfill, along with three separate influent streams from the Joint Base Elmendorf-Richardson (JBER). In addition to the toxicity testing, supplemental chemistry samples will be obtained at the same time and analyzed for the same suite of priority pollutants and pesticides that are currently included in the AWPCF permit for monitoring influent and effluent.

A description of the pretreatment toxicity monitoring program is provided below.

3.1.2 Sampling Locations

The six influent source locations that will be examined include the following:

- Anchorage Regional Landfill leachate
- Merrill Field Landfill leachate
- Matsu Central Landfill leachate
- JBER Government Hill
- JBER Mountain View
- JBER Fort Richardson

Sampling will be coordinated with AWWU pretreatment personnel with the sampling team including one person each from AWWU and KEI. Where possible, 24-hour composite samples will be obtained at all locations to obtain more representative samples. If composite sampling is not possible, then discrete grab samples will be obtained. In addition to the six influent sites, a concurrent WET test will also be performed on the AWPCF effluent so that a direct comparison can be made.

3.1.3 Laboratory Methods and Sampling Frequency

This toxicity testing will follow the guidelines established by the EPA manual *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136) (EPA, 1994b).

The echinoderm fertilization test consists of exposing purple urchin sperm to various concentrations of each wastewater sample, after which subsequent effects on successful fertilization of the eggs are determined. The specific procedures used in this test are described below.

The Lab Water Control medium for this test consists of filtered (1 micrometer) seawater. Prior to preparing dilutions, each wastewater sample will be adjusted to the test salinity of 34 parts per thousand (ppt) using Tropic Marin® artificial sea salt. The Lab Water Control medium and salinity-adjusted 100 percent wastewater samples will then be used to prepare interim test solutions at concentrations of 0.175, 0.35,

0.7, 1.4, 2.8, 5.6, and 11.2 percent of each wastewater sample, which is consistent with the current WET testing regime in the AWPCF NPDES permit. As an additional QA measure, and in order to assess potential adverse effects resulting from the use of the artificial sea salt, a salt control treatment will also be prepared and tested. Routine water quality characteristics (ammonia, dissolved oxygen, pH, and salinity) will be measured for each test solution prior to use in this test.

Each toxicity test will include four replicates at each test treatment. Each test replicate consists of a 30-milliliter (ml) glass vial to which 5 ml of appropriate test solution is added. The test is initiated with the inoculation of an appropriate quantity of sperm into each replicate vial to achieve a final sperm-to-egg ratio of 500:1. After a 20-minute exposure period, approximately 1,000 eggs are inoculated into each vial. After an additional 20-minute exposure, the test is terminated with all of the test embryos being fixed by the addition of 0.5 ml of 1 percent glutaraldehyde. The contents of each preserved test vial are then examined microscopically to determine the presence of fertilization envelopes and the percentage of embryos exhibiting successful fertilization. The resulting fertilization data for each test treatment are then analyzed to characterize any statistically significant reductions in successful fertilization that may have been caused by the effluent.

In addition to the toxicity test performed on each sample, a standard reference toxicant bioassay will also be performed using the same test population of organisms to ensure the tests are valid and fall within the laboratory control limits for the urchin test as required by the EPA methodology.

In conjunction with the toxicity sampling and testing, concurrent chemistry samples will be obtained and analyzed for a suite of toxic pollutants and pesticides that include total recoverable metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), dioxin, organophosphate (OP) pesticides, organochlorine (OC) pesticides, and polychlorinated biphenyls (PCBs). The complete suite of analytes is provided in later QC tables in this QAPP.

It is expected that the sampling frequency for the supplement toxicity testing of the various influent sources will be a one-time effort with any future sampling dependent on the results of this monitoring. Future efforts could include additional influent source testing, toxicity identification evaluation of the AWPCF effluent, or toxicity reduction evaluations.

3.1.4 Field Sampling Equipment and Procedures

If possible, all sampling activities will be performed with an ISCO® or equivalent composite sampler. Composite samples will be obtained as either 24-hour flow-based or 24-hour time-based composites, with the type of composite depending on whether a compatible flow sensor already exists at the sample location. If composite sampling is not possible based on the circumstances at a particular site, a grab sample will be collected for each test. Composite samples will be taken directly into pre-cleaned 10 or 20-L borosilicate sample bottles that will be either refrigerated or chilled with ice. At the end of the 24-hour composite period, subsamples will be transferred to sample containers and appropriately packaged for shipment to the laboratories. All toxicity testing will be performed by Pacific EcoRisk, Inc., the same laboratory that has been performing the quarterly WET testing for the AWPCF for over 10 years. Chemistry analyses will be performed by ALS Environmental.

Equipment items to be used for collecting the influent or effluent toxicity samples are listed here:

- 4-liter cubitainers for toxicity
- Chemistry sample bottles – various sizes
- Metal-free coolers
- Bubble wrap for cooler packing
- Gel ice
- Non-talc gloves
- Field logbook, COCs, labels, strapping tape, and custody seals

Water samples will be collected according to the following procedure:

- Non-talc gloves will be donned prior to contact with any sampling equipment or sample containers.
- Grab samples will be collected directly into pre-cleaned borosilicate sample bottles.
- Composite samples will be collected into pre-cleaned borosilicate bottles and subsampled into individual sample containers at the end of the 24-hour composite period.
- All sample containers will be new, pre-cleaned, and pre-labeled prior to the collection effort. When collection is complete, the samples will be immediately stored on ice in a metal-free cooler and prepared for transport to the analytical laboratories.

All samples will be shipped or delivered to the bioassay and chemical laboratories within holding times specified for each analysis type. Specifics on sample handling, custody, preservation, and sample shipment are provided in Section 4 of this document.

3.1.5 Data Evaluation

To determine compliance with permit limits, results of the WET test will be compared to the acceptable chronic toxicity unit (TUc) of 143. Results of the individual influent samples from the leachates and JBER will then be compared to the effluent test results. Comparisons will include calculations of the no observed effects concentration, 25 percent observed effects concentration (EC_{25}), and 50 percent observed effects concentration (EC_{50}) to determine if any of the influent sources may account for a significant portion of the AWPCF effluent toxicity. Statistical analyses for the toxicity testing will be performed by the laboratory using CETIS™ (TidePool Scientific Software).

In addition, chemical analyses will be utilized to further evaluate the results of the toxicity tests to determine if there are any specific pollutants that are at levels of concern and to compare levels between the six influent sources and historic data from AWPCF influent and effluent tests.

3.2 Receiving Water Quality – Priority Pollutants

3.2.1 Monitoring Objectives

The AWPCF's existing annual receiving water monitoring program includes hydrographic vertical profiles of temperature, salinity, pH, and dissolved oxygen along with discrete sample collections for turbidity, color, total residual chlorine, and fecal coliform at all sample locations. In addition, supplemental measures for total recoverable and dissolved metals, polycyclic aromatic hydrocarbons, total aromatic hydrocarbons (benzene, ethylbenzene, toluene, and xylenes), and cyanide are obtained at three outfall locations and three control site locations during the first drogue drop during the beginning of the flood tide at low slack water. The purpose of the receiving water study described in this QAPP is to collect additional supplemental samples at the same six locations to be analyzed for other primary pollutant contaminants that are not currently included in the existing NPDES monitoring program. The primary objectives of the AWPCF supplemental receiving water quality monitoring program are as follows:

- Collect supplemental priority pollutant water quality data to evaluate compliance with applicable water quality criteria at the edge of the zone of initial dilution (ZID).
- Determine water quality conditions at stations increasingly removed from the ZID and establish the ambient background for the parameters of interest.

A description of the receiving water quality monitoring program is provided below.

3.2.2 Field Sampling Locations

Sample locations for the annual monitoring program include 12 on the ebb tide at the outfall, 12 on the flood tide at the outfall, and an additional 12 on the flood tide at control locations for comparison. Sample locations are <u>not</u> fixed but determined during each survey by dropping a current drogue at the outfall's

diffuser and following the drogue for approximately 1 hour. Four sample locations are then established along the drogue's path; at the outfall within the ZID, ZID boundary (650-meter [m] distance), near-field (~1,300 m) and far-field (~2,000 – 2,500 m). This process is repeated three times for the ebb tide and three times for the flood tide at the outfall, with an additional three at the Point MacKenzie background control site.

The supplemental priority pollutant sampling includes the first flood drogue drop, which is considered "worst-case" in terms of mixing and low currents with samples obtained over the outfall, at the ZID boundary, and at a near-field location, with an additional three obtained along the first flood control drogue's path. All supplemental samples will be obtained as near-surface grab samples, with sampling taking place directly into pre-cleaned sample containers to avoid any decontamination cleaning procedures.

Vessel navigation will be conducted using a Wide Area Augmentation System (WAAS)-enabled differential global positioning system (DGPS) for determining position of the receiving water monitoring locations, using latitude and longitude coordinates.

3.2.3 Analytical and Field Parameters and Sampling Frequency

The supplemental priority pollutant receiving water sampling will take place in summer 2022 in conjunction with the permit-required receiving water monitoring and, potentially, will be repeated in 2023, depending on the results of the 2022 monitoring effort. In addition, this sampling will be performed at the same time as the early summer priority pollutant sampling for the influent, effluent, and sludge. This concurrent sampling will allow a direct comparison of what is being discharged at "end of pipe" with that seen within the ZID and ZID boundary locations.

The annual supplemental receiving water priority pollutant analyses include VOCs, SVOCs, dioxin, OP pesticides, OC pesticides, and PCBs as detailed in Section 4 below. Section 4.3 summarizes the analytical laboratories responsible for analyzing the parameters. Analyses will be conducted according to the procedures in *Methods and Guidance for Analysis of Water* (EPA, 1997) and updated in 40 CFR Part 136.

3.2.4 Field Sampling Equipment and Procedures

The KEI's 26-foot *North Forty* survey vessel will be used to collect the annual receiving water samples. The vessel will slowly approach the drogue in an upwind and up-current direction until the vessel is adjacent to the drogue, when sampling will be initiated. Typically, the sampling vessel is allowed to drift during the sampling operations due to the high currents in Cook Inlet and issues with safely anchoring. However, for this supplemental sampling that will be performed near low-slack water, it is planned that the vessel will anchor at the sampling location to minimize drift as a large number of sample bottles need to be filled. Sampling station locations will be based on the distance from the outfall along the drogue's path rather than a fixed station location to ensure that sampling is taking place within the outfall plume as the plume's trajectory changes throughout the tidal cycle.

A maximum of 30-meter deviation from the target distance for the sampling station will be tolerated during collection of samples at the outfall. If the vessel drifts beyond the 30-meter distance, the sampling activities will be terminated until the vessel maneuvers to the correct position. Total water depth at each sampling location will be determined using a calibrated fathometer.

If possible, all sampling activities will be conducted upstream and upwind of the engine's exhaust to minimize risk of sample contamination during sampling activities. If possible, the vessels engine will be shut off during the supplemental sampling effort.

Equipment to be used for collecting the receiving water samples are listed here:

- Metals-free coolers
- Sample bubble bags
- Blue ice

- Non-talc gloves
- Field logbook

The receiving water samples will be collected according to the following procedure:

- Non-talc gloves will be donned prior to contact with any sampling equipment or analytical containers.
- Grab samples will be collected near-surface by sampling directly into the sample containers to avoid any time-consuming decontamination/cleaning procedures that would typically be required for a Niskin bottle or other type of water quality sampling apparatus.
- Water samples will be manually collected by lowering the sample container to just below the water surface and allowing it to gently fill while facing upwind and upstream. An extendable pole with a clamped sample container may be used to reach the sea surface.
- All sample containers will be new, pre-cleaned, and pre-labeled prior to the collection effort. When collection is complete, the samples will be immediately stored on ice in a metals-free cooler, preserved (if required), and prepared for transport to the analytical laboratory.

All samples will be shipped or delivered to the respective analytical laboratories within specified holding times. Specifics on sample handling, custody, preservation, and sample shipment are provided in Section 4 of this document.

Observations, such as weather and sea conditions and unusual field conditions, will be recorded in the field logbook as described in Section 4.

3.2.5 Data Evaluation

To determine compliance with applicable criteria, water quality data collected for the AWPCF receiving water quality monitoring program will be compared with the applicable State of Alaska water quality including site-specific criteria for Knik Arm of Upper Cook Inlet that include chronic, acute, and human-health criteria for various constituents.

If additional data analyses are warranted, descriptive and inferential statistical methods may be applied to summarize variability within the receiving water data, or to identify significant differences in results between stations. For the existing monitoring program, statistical comparisons between the three outfall and three control locations are typically performed to determine if there are any significant differences that can be attributed to the AWPCF discharge.

3.3 Current Measurements

3.3.1 Data Collection Objectives

The primary objectives of obtaining accurate current measurements in the vicinity of the AWPCF outfall are to: (1) establish critical low flow and high flow velocities that will be necessary for the dilution modeling and (2) determine potential plume travel and residence times for acute exposures for pollutants of concern. Existing historic data from the vicinity of the AWPCF outfall are very limited, with most data over 40 years old. Therefore, there is a need to collect new hydrodynamic information in the vicinity of the discharge using modern acoustic doppler technology that is not constrained by the high tidal currents in Upper Cook Inlet.

3.3.2 Sampling Locations

Currents in Upper Cook Inlet exhibit large variations over both the semidiurnal tidal cycle and the monthly lunar cycle of neap and spring tides. Therefore, the duration of the current study will extend for a minimum of a 15-day period to capture a range of minimum and maximum tides, including a neap and spring tide cycle.

For redundancy and to determine any current velocity variations in the vicinity of the diffuser, currents will be measured at two locations with bottom-mounted acoustic doppler current profilers (ADCPs). Potential target locations are shown in Figure 3-1. Final locations will be determined based on the results of the planned bathymetry survey because the bottom mounts should be placed in relatively flat or gradually sloping areas without boulders or other obstructions. Ideally, the target locations should be within the existing ZID but outside of any expected influence of the outfall on ambient currents.

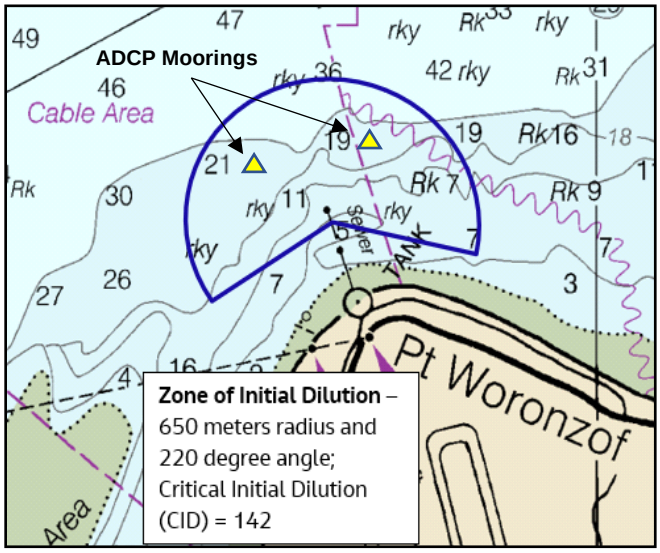


Figure 3-1. ADCP Target Locations

3.3.3 Field Sampling Equipment and Procedures

The moorings were designed so that all components would be on the sea bottom with no surface buoys or other components in the water column to avoid potential vandalism and avoid presenting a navigation hazard to any vessels that may traverse through the area. Each current meter mooring will consist of the following components:

- Low-profile weighted aluminum tripod bottom mount with ADCP gimbal to accommodate variations in bottom slope, if needed
- Teledyne/RDI Workhorse Sentinel 300 or 600 kilohertz ADCP
- EdgeTech Port low-frequency or equivalent acoustic transponder/release for mooring retrievals
- Popup buoy retrieval system that will be coupled with the transponder/release
- Secondary anchor with a poly groundline to serve as backup recovery method in the event of an acoustic release failure

Deployment and retrieval of the current moorings will be from KEI's 26-foot *North Forty* survey vessel that includes a portable A-frame/davit with capstan-winch that will allow for safely lowering and raising a relatively heavy (200 to 250 pounds) bottom mount. All deployment and retrieval operations will be performed at either low-slack or high-slack water to allow accurate placement of the moorings at the desired locations and to facilitate operations. Positioning of the moorings will be accomplished with a DGPS that will allow accurate placement in relation to any mapped bottom obstructions or areas with large variations in seabed slopes. Final locations of each mooring component will be recorded on a customized field documentation sheet at the time of deployment to allow accurate relocation and recovery of each mooring.

Each ADCP will be programmed prior to deployment to measure 1- to 2-meter vertical bins extending from near-bottom just above the ADCP to the water surface. Measurements of current speed and direction as well as temperature will be performed at 6-minute intervals to coincide with the water level

measurements from the National Oceanic Survey water level gauge located at the Port of Anchorage. This will allow an accurate cross-comparison between measured currents versus actual fluctuations in water levels. Following retrieval, each ADCP's data will be uploaded to a laptop computer for post-processing.

3.3.4 Data Evaluation

Data analysis will consist of a variety of time-series techniques, including both statistical analysis and various graphical presentations to include the following:

- Color time-series plots showing variations in current speed versus depth and time
- Polar plots depicting current speed and direction
- Progressive vector diagrams
- Stick plots.

Statistical analysis will include calculating probability distributions for both ebb and flood tides for determining the critical low-flow (10th-percentile), median flow (50th-percentile), and high-flow (90th-percentile) current velocities. These current measurement data will be used in the dilution modeling. Data analyses, presentations, and interpretations will be presented in a technical memorandum to support the modeling efforts.

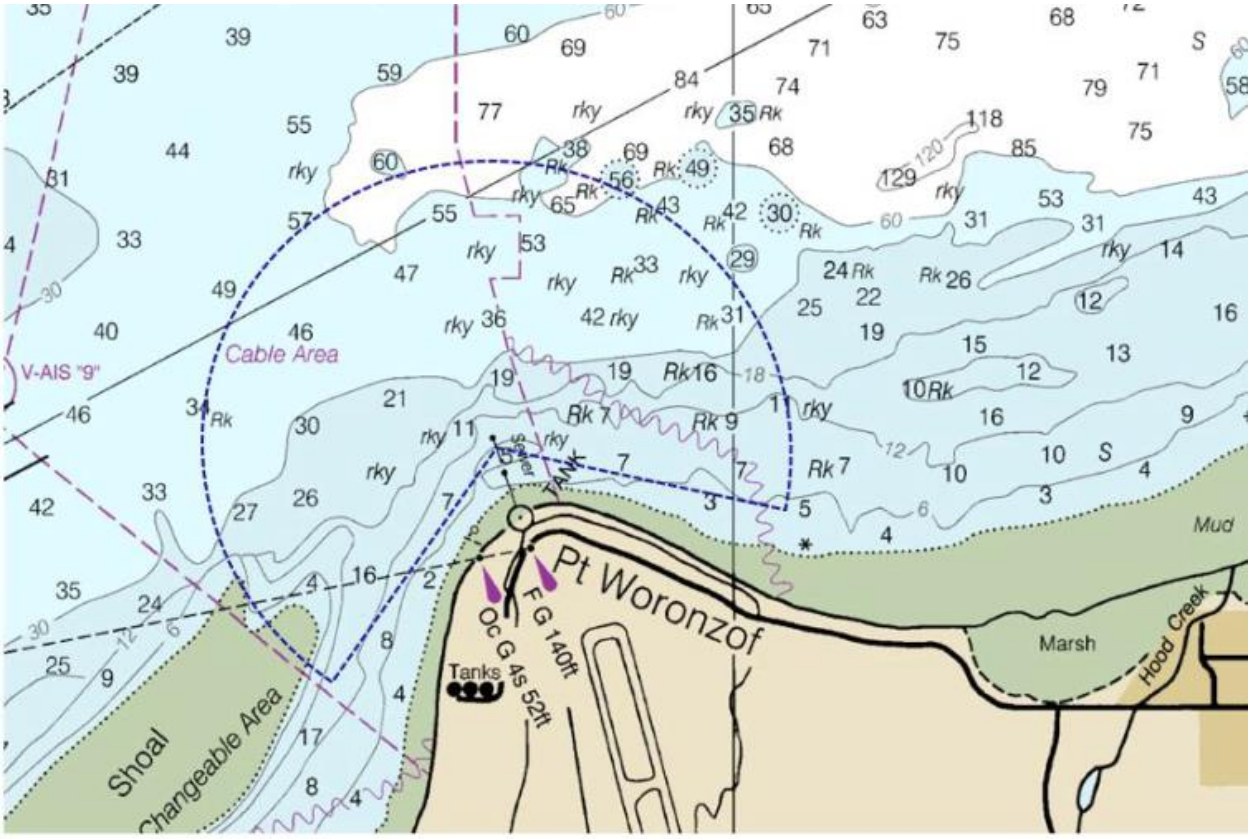
3.4 Marine Bathymetry and Surficial Habitat Survey

3.4.1 Data Collection Objectives

The objectives of recording seabed bathymetry and surficial substrate characteristics in the vicinity of the AWPCF outfall include developing detailed documentation of seabed elevations, bedform conditions, and seabed surface habitat type near Point Woronzof and the AWPCF outfall. These data collections will also be used to define locations for marine sediment sampling, sites for ADCP current meter deployments, and as an important input to updates to the Upper Cook Inlet Environmental Fluid Dynamics Code numerical model.

3.4.2 Sampling Locations

The target survey region will include the bed area within approximately 1,500-m radius of the AWPCF outfall diffuser site off Point Woronzof in Cook Inlet (Figure 3-2). The actual bathymetry survey region will be limited in the nearshore areas by water depths and migrant shoals that cannot be surveyed due to shallow conditions and vessel safety concerns.



(Approx. 1,500 yds radius for bathymetry survey with limitations to avoid shallow depths)

Figure 3-2. Target Bathymetric Survey Region off Point Woronzof in Cook Inlet

3.4.3 Field Sampling Equipment and Procedures

Multibeam Echosounder (MBES) point cloud bathymetry and backscatter acquisition will be recorded during the field survey work days. Survey data will be acquired using either an R2Sonic 2022 or a Norbit iWBMS MBES system. The orientation and positioning will be measured and updated using a PosMV Inertial Navigation System, which will receive real-time kinematic position corrections from a base station positioned on shore and broadcasting to the roving survey vessel. Both point survey data and backscatter data will be recorded in Hypack/Hysweep navigation software, and all acquisitions will be overseen by a Certified Hydrographer.

The survey acquisition accuracy will be a minimum of 20 points/m over the AWPCF outfall diffuser turret and the immediate vicinity of the outfall turret. For all other survey regions the targeted survey acquisition accuracy will be 10 points/m, with a minimum acceptable coverage of 5 points/m for depths shallower than 20-m (except the outfall turret site).

This survey region off Point Woronzof is known for dangers to navigation and other obstructions that may migrate or move. Because all the nearshore dangers to navigation are not known, portions of this survey will need to be executed with caution and under conditions of limited vessel mobility where the vessel only operates within zones of previous survey boundaries.

3.4.4 Data Evaluation

The bathymetry data will be processed in Caris HIPS software. Caris SIPS software will be used to process the backscatter acoustic imagery. The Point Cloud, surface, and 1-foot elevation contours will be produced referencing Horizontal Datum North American Datum of 1983, Alaska State Plane in the appropriate zone. The Bathymetry (elevations) will be calculated on two vertical datums, both North American Vertical

Datum of 1988 and National Geodetic Vertical Datum of 1929 to match the modern and legacy outfall information.

Survey products will include XYZ point files (ASCII *.CSV, on the various vertical datums), 1-foot contours (*.SHP, on the various vertical datums), a color elevation image of the seafloor, Backscatter Acoustic Imagery Mosaic (as a Georeferenced Tiff), and an Obstruction Table and Danger to Navigation Target List (*.SHP). All drawings will be in U.S. Survey Feet and all charts will include the Certified Hydrographer stamp & signature. Each e-Chart will be produced in a layered PDF format.

AutoCAD DWG drawings in Civil 3D will be produced for the survey region at Point Woronzof. These DWG drawings will include two Seafloor Surfaces and two 1-foot contours charts, the Acoustic Imagery layer, and any obstructions or Dangers to Navigation.

3.5 Marine Sediments

3.5.1 Data Collection Objectives

Sediment quality monitoring is integral to the 301(h) waiver and NPDES renewal data collections program. The sediment quality monitoring has been limited under the existing AWPCF 301(h) permits, but historically it included priority pollutant analyses in both intertidal and subtidal sediment. The most recent sediment sampling occurred in 2003, as required under the existing NPDES permit. The primary objectives of the sediment analyses performed as part of this 301(h) waiver and NPDES renewal data collections program are as follows:

- Collect surface sediments for analysis of priority pollutant and 301(h) pesticide data, along with concomitant data, to assess the potential presence of pollutants at concentrations that exceed available benchmark screening concentrations.
- Determine if the AWPCF discharge is resulting in accumulation of any pollutants within the ZID, nearshore subtidal environments, or intertidal areas near the outfall by comparing outfall versus control (reference) locations.
- Compare newly collected sediment data with historical data, where applicable, to help assess potential changes in sediment quality (organic enrichment, alteration of grain size distribution, and pollutant contamination) over time.

3.5.2 Field Sampling Locations

Sediment sampling efforts performed for the current AWPCF NPDES permit included three intertidal and two subtidal sampling sites in 2003. At a minimum, these same five sites will be sampled for this monitoring program to support the NPDES permit and 301(h) waiver renewal effort. In addition, four other locations may be sampled if fine sediments are indicated based on the bathymetry survey described in Section 3.4. The bathymetric results should indicate if areas of finer-grained sediments (i.e., sands/silts) are present as these materials are amenable to collection and chemical analysis, while extremely coarse-grained sediments such as pebble/cobble substrates cannot be subject to chemical analysis. Therefore, nine sediment sites will be targeted for sampling and will be submitted for chemical and physical analyses if substrates allow. Three replicate samples will be collected at each of the sites to allow statistical comparisons. In addition, the laboratory will run duplicate field samples at rate of 1 in 10 for QC, resulting in a target of 30 sample analyses overall.

This sediment collection effort will be performed in conjunction with the benthic infauna collection effort described in Section 3.6, with sediments being collected at each sampling site for both chemistry analysis and benthic infauna sample analysis.

Subtidal sampling sites will be located up- and down-coast of the Point Woronzof outfall and the Point MacKenzie control site locations where currents are reduced and where finer-grained sediments exist rather than cobble. Intertidal stations will be located in accessible areas near the beach at Point Woronzof where sampling occurred in 2003. Three replicate sediment chemistry samples will be collected from

within a 10-meter radius at random distances and bearings from each target location, as is consistent with past monitoring procedures.

Figure 3-3 and Table 3-1 include the locations of the target sediment sampling stations. All station locations except those that are historical, as detailed in the existing AWPCF NPDES permit (i.e., IT-1, IT-2, and IT-C), will be sited based on prevailing tidal currents and the bathymetric data, along with the availability of fine-grained sediments as observed in the field during sampling.

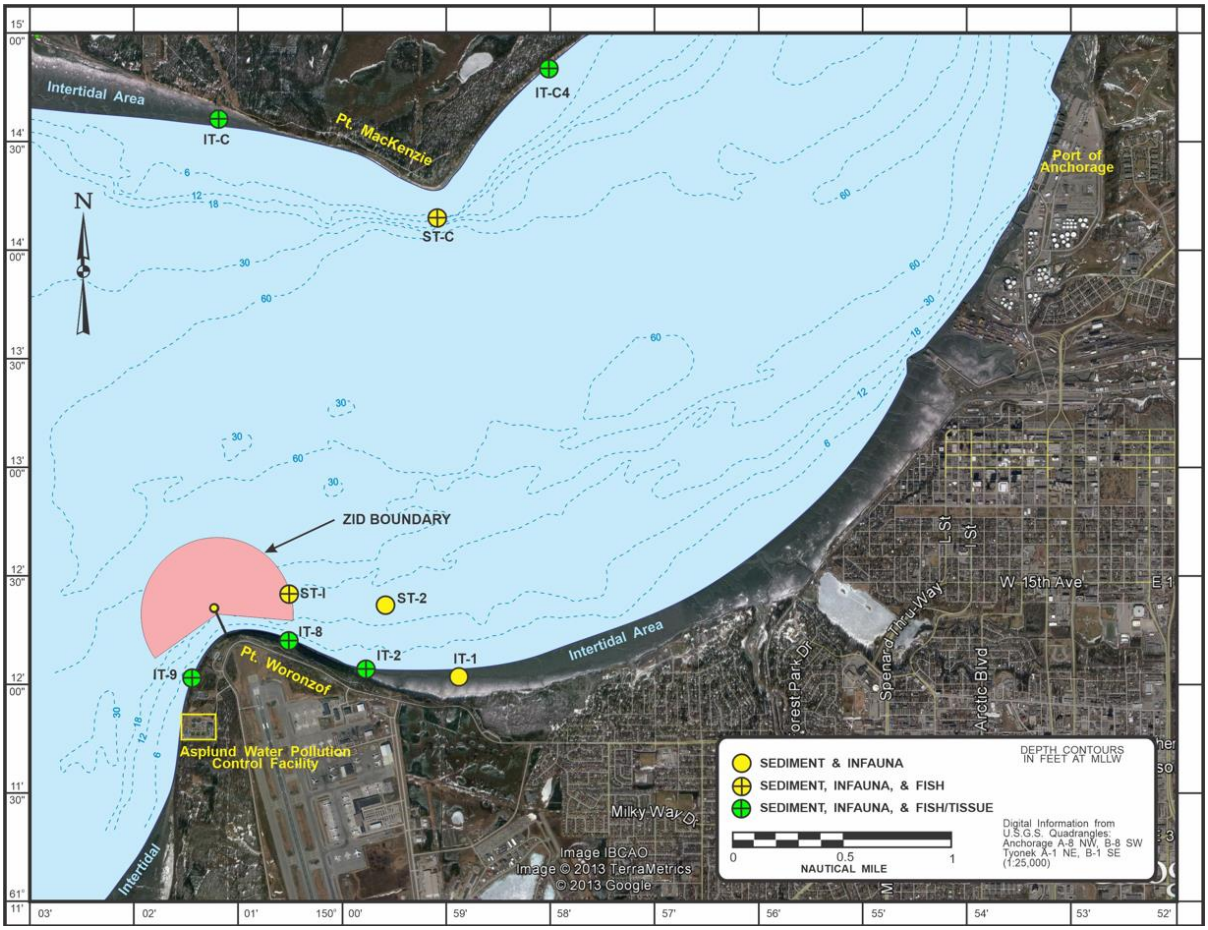


Figure 3-3. Subtidal (ST) and Intertidal (IT) Target Sites for Sediments, Benthic Infauna, and Fish Tissue Sampling off Point Woronzof in Cook Inlet

Vessel and onshore intertidal navigation will be performed using a WAAS-enabled DGPS for determining position of the sediment monitoring locations, using latitude and longitude coordinates. All sampling location latitude/longitude coordinates will be recorded on customized field documentation at the time of sampling.

Table 3-1. Target Sediment Sampling Stations

Station No.	Station Type	Station Depth	Station Location	Latitude	Longitude
IT-1	Existing	Intertidal	2,000 meters east of Outfall	61° 12' 10"	149° 58' 55"
IT-2	Existing	Intertidal	1,200 meters east of Outfall	61° 12' 11"	149° 59' 50"
IT-C	Existing	Intertidal	North on Point MacKenzie side, across from diffuser (Control)	61° 14' 26"	150° 01' 8.7"
ST-1	Existing	Subtidal	Outfall ZID boundary	TBD	TBD

Table 3-1. Target Sediment Sampling Stations

Station No.	Station Type	Station Depth	Station Location	Latitude	Longitude
ST-C	Existing	Subtidal	Control at same depth as ST-1 station	TBD	TBD
IT-8	Proposed	Intertidal	Intertidal in eastern nearshore area within ZID Boundary	TBD	TBD
IT-9	Proposed	Intertidal	Intertidal in western nearshore area within ZID Boundary	TBD	TBD
ST-2	Proposed	Subtidal	Near-field site east of Outfall ~1,200 meters	TBD	TBD
IT-C4	Proposed but historical	Intertidal	North of Point MacKenzie at historic IC4 site	TBD	TBD

TBD = to be determined in the field.

3.5.3 Analytical and Field Parameters and Sampling Frequency

Sediment samples will be collected from each target station once during the summer of 2022 and screened for EPA priority pollutants, 301(h) pesticides, and concomitant parameters. Analysis of sediment samples will include priority pollutants and pesticides, including VOCs, SVOCs, dioxin, OP, and OC pesticides, and PCBs, along with sediment particle size distribution (sieve and hydrometer American Society of Testing and Materials [ASTM] methods), total organic carbon (TOC), total volatile solids (TVS), ammonia, and percent solids as well as photo documentation and a field description of physical characteristics. A complete list of target analytes along with analytical methods, method detection limits (MDLs), reporting limits, and QC acceptance criteria are detailed in Section 4.

All analyses will be performed according to the procedures in *Test Methods for Evaluating Solid Waste (*EPA, 1986) and updated in 40 CFR Part 136.

Section 4.3 presents a summary of the analytical laboratories responsible for the analyses of all the parameters.

3.5.4 Field Sampling Equipment and Procedures

Sediment sampling will be performed from KEI's 26-foot *North Forty* survey vessel supported with a 16-foot Zodiac skiff equipped with an outboard motor for accessing the beach and shallow-water areas from offshore. Some intertidal sites near Point Woronzof may also be accessed from shore.

Sample handling and preservation methods will be consistent with those presented in *Procedures for Handling and Chemical Analysis of Sediment and Water Samples* (EPA/CE-81-1) (EPA and USACE, 1981) and *Quality Assurance/Quality Control (QA/QC) for 301(h) Monitoring Programs: Guidance on Field and laboratory Methods* (EPA 430/9-86-004) (EPA, 1987).

Equipment items needed for the collection of sediment samples are listed below:

- Pipe dredge
- Manual Carr® Corer or AMS® Sediment Corer (stainless steel)
- Decontamination supplies: plastic scrub brushes, site water, phosphate-free scientific detergent, and potable and de-ionized water
- Tape or ruler for penetration measurement and substrate photographs
- Talc-free gloves

- Nonmetallic spatulas and spoons
- Pre-cleaned glass or other containers as required by analytical method
- Gel ice
- Metals-free coolers and packing material, including bubble bags
- Customized field documentation (field logs, sample labels, COC forms)
- Photographic equipment

Sediment samples will be collected at each of the stations using the following procedures:

- The pipe dredge will be utilized to collect subtidal sediment chemistry samples from each target location. Alternatively, if feasible, a hand-driven Carr or AMS coring device may be utilized in lieu of the pipe dredge at low slack tide to collect relatively undisturbed sediment from subtidal areas. Intertidal samples will be collected using a hand trowel or hand coring device during low tide periods. Actual locations will be recorded for hand-collected samples; for the pipe dredge, coordinate locations will be recorded at the beginning and end of each dredge tow.
- When the sampling equipment is retrieved, it will be visually inspected to determine that there was collection of finer sediments from the bottom. While attempts to collect the undisturbed natural surface layer of the subtidal bottom will be made, due to the rocky nature of the bottom in the survey area, it is likely that collection of undisturbed sediments will be extremely difficult. Subtidal pipe dredge samples will be photographed upon retrieval to document collection and substrate type, and to also document sample disturbance, which is expected to be extensive in extremely coarse sediments and cobble in which the pipe dredge is likely to be utilized. Cored samples may be photographed as well to document surface integrity, but it is anticipated that undisturbed sediments will be more readily collected by this sampling method; depth of penetration will be recorded for sediment samples obtained by coring.
- While the original AWPCF permit required the collection of the top 2 centimeters of sediment for chemical analysis, historical sampling has indicated that collection of fine sediments is extremely difficult due to the high current speeds and bed scour in Knik Arm, and the presence of cobble and other coarse substrates. If sediment samples are only obtained from gravel or pebble/cobble substrates, analyses for grain size distributions will be performed on representative samples only; chemical analyses for priority pollutants and pesticides along with TVS, TOC, and ammonia will be performed only on finer sized fractions that consist of combined sand, silt, and clay.
- Non-talc gloves will be donned by personnel prior to contact with any sampling utensils or analytical containers.
- A nonmetallic spatula or comparable non-contaminating utensil will be employed for sub-sample collection of the sediments from the corer. Surficial sediments will be recovered only from the center of the sampler to avoid sediment that is in direct contact with the surfaces of the equipment if possible; however, due to the nature of corers themselves, sediments are anticipated to be disturbed in nature, and it is expected that the collected sediment may have come into contact with the equipment's surfaces.
- Sample fractions to be analyzed for the various analytical parameters will be collected directly into the appropriate pre-labeled new or precleaned sample containers as prescribed by method and the analytical laboratory. Sediments will not be composited. The sample containers will be filled as called for by analytical method, including the avoidance of head space when necessary. Should insufficient sample material exist, analysis types may be prioritized to allow for analysis of sediments from the target stations even if fine-grained sediment is somewhat sparse.
- All samples will be placed in coolers and chilled with gel ice while onboard the sampling vessel. Most sediment samples do not require chemical preservative, but VOC samples requiring methanol will be preserved on shore at the end of the sampling day and prior to shipment to the laboratory.

- At the completion of sampling at each station or prior to the next use, all utensils and samplers will be properly decontaminated as described in Section 4.5. In summary, decontamination will consist of rinsing with site water, washing with a phosphate-free detergent wash, and triple-rinsing with deionized water. No solvents or other cleaning agents will be used. Between stations, decontaminated equipment will be stored in an environment free of hydrocarbons (vessel exhaust) or metallic surfaces to prevent recontamination. Any sampling equipment suspected of contamination will be decontaminated again before reuse.

All samples will be shipped or delivered to the respective analytical laboratories within holding times with appropriate preservative, if any, including temperature requirements, and under stringent COC procedures. Specifics on sample handling, custody, preservation, and sample shipment are provided in Section 4 of this document.

Field observations, including sample collection details, navigational information, weather, sea conditions, and unusual field conditions will be recorded in the field logbook as described in Section 4.

3.5.5 Data Evaluation

Sediment data will be used in conjunction with the biological monitoring records to evaluate whether there are measurable effects from the AWPCF discharge in the marine sediments. In addition, these data will allow limited station-to-station comparisons of sediment characteristics, with emphasis on comparing sediments at the control and near-field stations with conditions documented near or just inside of the ZID boundary. These sediment data will also be evaluated against quantitative benchmark values to assess the potential presence of detectable concentrations of these pollutants at concentrations that exceed available screening concentrations and to determine if data patterns provide any evidence of pollutant presence at levels of potential concern. Results from the sediment quality study will be presented in tabular presentations of the data along with any statistical analyses and interpretations.

3.6 Benthic Infauna Community

3.6.1 Monitoring Objectives

Benthic infauna community monitoring is generally recognized as being one of the most relevant biological monitoring approaches for assessment of effects of effluent discharges to receiving waters. The *Revised Section 301(h) Technical Support Document* (EPA, 1982) indicates that the specific objective of this monitoring element is to provide evidence regarding "…whether or not a balanced indigenous population (BIP)… exists in the vicinity of the discharge and in other areas potentially affected by the discharge" (page II-6, EPA, 1982). Therefore, the primary objectives of the benthic monitoring program are as follows:

- Document the general lack of benthic infauna in Knik Arm and Upper Cook Inlet as a result of the magnitude of tidal currents and seabed scour.
- Assess the potential presence of BIPs of benthic invertebrate communities within and beyond the ZID to evaluate potential effects of the discharge.
- Assess benthic invertebrate communities at a control station removed from the AWPCF discharge for comparison purposes.
- Compare benthic invertebrate data with historical data, as available.

Biological sampling in conjunction with the AWPCF NPDES permit-required monitoring program was last performed in 1989 under the previous AWPCF NPDES permit, but no benthic analyses have been performed since that time and benthic infauna community monitoring is not included in the current discharge permit.

3.6.2 Field Sampling Locations

Benthic infauna community sampling and analyses will be performed in conjunction with the sediment sampling described in Section 3.5 at the same intertidal and subtidal locations. This includes sampling at five historical sites along with four potential additional sites being targeted for this program based on the bathymetry data. Therefore, nine sites will be targeted for benthic infauna sampling and analysis. Of these stations, however, based on prior experience and knowledge of the site, it is anticipated that only the six intertidal sites will allow the collection of sediments for benthic analysis. The subtidal substrate in the study area is very coarse, as shown by past sampling efforts under the current and previous AWPCF permit. It is anticipated that benthic sampling of the subtidal locations will not be possible because these stations may require the use of a pipe dredge to obtain any bottom material. Use of the pipe dredge will not provide a specific and repeatable surface sediment sample area or volume and will prevent quantitative analysis and statistical comparisons of benthic organisms collected from pebble/cobble substrate areas.

Benthic infauna community sampling stations are listed in Table 3-1 and depicted in Figure 3-3 in Section 3.5. Benthic infauna sampling will include collection of six replicate samples collected at random distances and bearings within a 10-meter radius of the target station location. Intertidal sampling will occur at the mid-tide height levels to be consistent with past monitoring efforts. Subtidal sampling will optimally occur at low slack tide.

3.6.3 Analytical and Field Parameters and Monitoring Frequency

Six replicate grab samples at each benthic infauna sampling station will be taken once during this program year and sieved through a 0.5-millimeter (mm) mesh screen for infauna organisms. For each replicate sample, organisms will be identified to species, or to the lowest practicable taxonomic level (e.g., "Oligochaeta") and enumerated in the laboratory to provide incidence and abundance records to support community characterizations relevant to BIP analyses for the 301(h) waiver and NPDES permit renewal application supplement.

The sediment grain size and supporting chemistry data collected at these same stations in conjunction with the sediment sampling may be used to support interpretation of temporal and spatial differences in benthic infauna community composition based on differences in substrate. Section 4.3 presents a summary of the analytical laboratories responsible for the analyses of all the parameters.

3.6.4 Field Sampling Procedures

Benthic sampling will occur at the same time as sediment collection and utilize the same sampling vessels or shoreline access as described in Section 3.5. Vessel positioning and navigation will also be conducted in the same manner as described in Section 3.5. It is anticipated that subtidal benthic sample collection will be difficult because of the hard-bottom conditions that may exist near the target stations because much of the offshore area in the vicinity of Point Woronzof is scoured and heavily armored with cobble.

Benthic infauna sampling will be conducted in accordance with applicable portions of *Procedures for Handling and Chemical Analysis of Sediment and Water Samples* (EPA and U.S. Army Corps of Engineers [EPA and USACE, 1981]). Benthic collections will be performed as allowed by the State of Alaska Department of Fish & Game Scientific Permit that will be obtained by KEI once this QAPP is finalized.

Equipment items needed for the collection of sediment samples for benthic analyses are listed below:

- Carr corer or similar hand corer (14.6 centimeters diameter)
- Pipe dredge
- Tape or ruler for penetration measurement and substrate photographs
- Sample buckets
- 0.5-mm mesh field sieves
- Forceps, probes, funnels, spoons, magnifiers, squirt bottles

- Ambient water filtration system, hose, spray nozzles, etc.
- Rose bengal and propylene phenoxytol for staining and anesthetizing
- 10 percent formalin buffered with borax
- 70 percent ethanol
- High-density polyethylene (HDPE) leak-free containers
- Coolers and packing material, including bubble bags
- Customized field documentation (field logs, sample labels, COC forms)
- Photographic equipment
- Field documentation materials

The benthic infauna sampling of unconsolidated sediments will be performed whenever possible using a 0.017-square-meter Carr corer (subtidal) or hand-corer (intertidal) that will be driven approximately 6 inches deep if the substrate allows. The Carr corer will allow the collection of discrete benthic samples while retaining the integrity of the surficial sediment; the AMS corer, which may be used if necessary for the collection of sediments for chemical analysis, is not appropriate for benthic sampling due to small size of the corer, disturbances of the sample material, and potential damage to organisms.

Subtidal coring using the Carr corer *may* be possible at a few locations, but it is more likely that the pipe dredge will have to be used for collection of the coarser sediments at most or all subtidal locations due to the substrate type. As noted above, the pipe dredge will not allow quantitative benthic infauna sampling, but these samples will be photographed to document the coarse nature of the bottom and the sparsity of fine-grained sediments and organisms in these subtidal areas.

Six replicate samples will be collected at each of the stations using the following procedures:

- The quality of each corer sample will be determined by visual inspection prior to processing. When the corer is retrieved, the sample will be visually inspected to determine that there was adequate retention of sediments and that fine surficial sediments remain within the corer. The natural surface layer of the sample should be relatively undisturbed, preferably with a layer of overlying water, but this will be inferred by the water content as the core must be removed from the corer completely to inspect the surficial layer.
- The overlying water, if present, will be placed into the same container into which the entire core is released and will be processed with the benthic infauna sample (i.e., poured through the 0.5-mm mesh sieve). The sample will be sieved to reduce the sediment sample volume and allow retention and preservation of only that portion of the samples containing sediment and detrital residues and the invertebrates.
- Sieves will be closely inspected prior to sieving each sample to ensure the integrity of the specified mesh size is maintained and after sieving to ensure there is no cross-contamination between samples. Only filtered ambient water will be used for sample sieving and transfer to sample containers.
- Once the sieving has been completed, each sample will be preserved in the field with 10 percent buffered formalin and placed in prelabeled HDPE containers. All formalin solutions will be buffered by adding borax until a pH of 7.5 to 8 is achieved. Rose Bengal, a staining agent, and propylene phenoxytol, an anesthetizing/relaxing agent, may be added to the samples to ease sorting (removal of organisms from sediment) and taxonomic identification of the organisms, depending on the substrate type, amount of detritus, and the type of organisms encountered.
- If a sample fraction volume exceeds half of the container volume, it will be split into separate containers to ensure that complete preservation of the entire sample with the formalin solution is successfully achieved. Each sample will be agitated carefully to ensure proper mixing of the formalin with the sediments to enhance preservation.

- All benthic infauna sample containers will be labelled both internally and externally using customized sample labels. Internal labels will consist of poly or cotton rag paper with pencil or indelible ink. Sample shipment, if any, will take place under stringent COC procedures as described in Section 4.
- Benthic infauna samples will be transferred to 70 percent ethanol at KEI's Anchorage facility after being in the fixative for at least 24 hours, but within 7 days of preservation. Benthic infauna samples will be sorted and analyzed at the KEI and at EcoAnalyts Laboratory by skilled invertebrate taxonomists to the lowest practicable level.

3.6.5 Data Evaluation

Benthic community characteristics will be compared between the control sites and site outside the ZID with the sites within the ZID. If sufficient benthic data exist, standard benthic invertebrate analytical metrics will be calculated, as appropriate, and may include the following:

- Species composition
- Total invertebrate density (number per square meter)
- Density (by lowest possible taxon)
- Number of species (total and by major taxonomic groups)
- Shannon-Weiner diversity
- Evenness
- Dominance Index
- Indicator species (pollution tolerant versus opportunist, etc.)

These types of biological metrics may be compared for a given station across time (temporal variability) as well as across stations (spatial variability), as appropriate. If deemed useful and sufficient data exist, the pooled or averaged station data may be used in a cluster analysis to investigate the relative similarity of the benthic communities at the various monitoring stations.

Statistically significant differences in comparative metrics will be evaluated carefully to support data interpretation. It is important to note the following:

> *The concepts of spatial extent of discharge-related biological effects and intercommunity effects are important in a BIP demonstration. For example, substantial changes to one or more biological communities may be acceptable within the ZID of an open coastal discharge that would not be acceptable in other areas of potential impact outside the ZID. Such substantial changes within the ZID, however, cannot contribute to extreme adverse impacts. Observed changes in one or more communities outside the ZID may also be acceptable so long as the applicant demonstrates no resulting substantial changes to other communities.* (page II-8, EPA, 1982).

Thus, even if substantive differences for some of the metrics identified above are found between stations, the benthic invertebrate monitoring records will need to be evaluated in conjunction with other directly relevant data sets (e.g., fish community data) to help determine if the invertebrate population differences have any ecologically meaningful impact on other communities.

Concomitant sediment particle grain size and TOC data will be used in conjunction with the biological monitoring records to evaluate whether there are measurable discharge effects. In addition, these data will allow station-to-station comparisons of sediment characteristics, with emphasis on comparing sediments at the control stations with those near the outfall. Sediment characteristics are strongly influenced by factors that are not necessarily accounted for by the distribution of the monitoring stations (i.e., variable depths and associated susceptibility to sediment resuspension, localized differences in ambient current regime, proximity to natural sources of sediments such as rivers or other estuarine environments, etc.), and these will need to be considered during the interpretation of the results.

Results from the benthic infauna community analysis will be presented in tabular and graphical presentations of the data along with any statistical analyses and interpretations.

3.7 Fish Community and Tissue Bioaccumulation

3.7.1 Monitoring Objectives

The objectives of this element of the data collections program are to (1) assess the abundance and distribution of demersal and nearshore fish communities in the vicinity of the AWPCF discharge and Knik Arm of Upper Cook Inlet and (2) measure tissue concentrations of priority pollutants in a relatively abundant fish species that is commonly present in the ZID and at the reference location to determine if the discharge has a potential to cause an increase in body burden of toxic chemicals in indigenous fish species. Species selected for this effort will depend on species abundance across sampling sites. Based on historical beach seining and bioaccumulation efforts conducted in 2004, it is expected that either juvenile Saffron cod (*Eleginus gracilis*) or Pacific cod (*Gadus macrocephalus*) will be the selected species (KLI, 2005). The bioaccumulation monitoring will focus on the following fish populations:

- Nearshore juvenile fish species may be sampled with a beach seine because it is not expected that the mid-water trawling effort will yield sufficient numbers of fish for bioaccumulation analysis.
- Species with known value as an important prey species for higher trophic level organisms. Other important commercially or recreationally sought fish for human consumption such as adult salmon or eulachon do not spend sufficient time in the vicinity of the outfall to be of use for this study's objectives and the proposed sampling methods are not expected to catch adult fish.

3.7.2 Field Sampling Locations

Field sampling locations for the fish community surveys will include five beach seining sites and two offshore mid-water trawl sites. Beach seining will include one site upcoast and one site downcoast from the outfall inside of the ZID boundary (~ 600-meter distance), one nearfield location at approximately 1,200-meter distance from the outfall, and two reference locations across Knik Arm to the northeast and west of Point MacKenzie (Table 3-2). Mid-water trawls will include two sites, one at the outfall along the ZID boundary and one across Knik Arm near Point MacKenzie.

Table 3-2. Target Fish Sampling Stations

Station No.	Station Type	Station Depth	Station Location	Latitude	Longitude
IT-2	Existing	Intertidal	1,200 meters east of Outfall	61° 12.183'	149° 59.833'
IT-C	Existing	Intertidal	North on Point MacKenzie side, across from diffuser (Control)	61° 14.433'	150° 01.145'
ST-1	Existing	Subtidal	Outfall ZID boundary	TBD	TBD
ST-C	Existing	Subtidal	Control at same depth as ST-1 station	TBD	TBD
IT-8	Proposed	Intertidal	Intertidal in eastern nearshore area within ZID boundary	TBD	TBD
IT-9	Proposed	Intertidal	Intertidal in western nearshore area within ZID boundary	TBD	TBD
IT-C4	Proposed	Intertidal	North of Pt. MacKenzie at historic IC4 site	TBD	TBD

TBD = to be determined in the field.

Vessel and onshore intertidal navigation will be performed using a DGPS for determining position of the fish monitoring locations, using latitude and longitude coordinates. All sampling location latitude/longitude coordinates will be recorded on customized field documentation at the time of sampling.

3.7.3 Analytical Parameters and Monitoring Frequency

The analytical parameters for whole fish tissue concentrations will include the same priority pollutant and pesticide list of analytes that is current being performed for the AWPCF annual effluent monitoring program, with the exception that tissues will not be analyzed for either asbestos or VOCs, because both asbestos and VOCs would not be expected in a tissue sample and because the selected laboratory does not perform tissue analyses for VOCs. Analyses will include metals, cyanide, SVOCs, OP and OC pesticides, PCBs, dioxin, and percent moisture as detailed in Section 4. All concentrations will be presented by the laboratory as dry weight.

The monitoring frequency for the fish community distribution and abundance surveys will include three separate sampling efforts to document any seasonal differences in species abundance and distribution. Ideally the surveys will be conducted during the spring, summer, and fall time periods. For the fish tissue bioaccumulation component of the study, monitoring will be performed once during either the summer or fall seasons with timing dependent on approvals for the biological sampling effort and success in collecting sufficient tissue for the chemical analyses. Due to the small size of individual fish, tissue analysis will be performed on composite samples collected at each site, with two replicate composite analyses performed for each location.

3.7.4 Field Sampling Equipment and Procedures

The field team will follow the general guidelines for sample collection provided in *Bioaccumulation Monitoring Guidance: 4. Analytical Methods for U.S. EPA Priority Pollutants and 301(h) Pesticides in Tissues from Estuarine and Marine Organisms* (EPA, 68-01-6938) (EPA, 1986). All fish collections will be performed as allowed by the State of Alaska Department of Fish & Game Scientific Permit that will be obtained by KEI once this QAPP is finalized.

Two sampling methods, beach seine and near-surface beam trawl, will be utilized for the fish collection survey, although the fish tissue collections will be limited to the beach seining effort unless sufficient tissue is obtained during the trawling effort. The following field equipment will be used:

- Small mesh (3/8-inch knotless) beach seine (4 feet deep x 40 feet long)
- 8-foot beam trawl
- Measuring board
- Taxonomic fish field guides/keys
- Sampling trays
- Aluminum foil sheets
- Ziplock bags
- Sample coolers
- Blue ice
- Non-talc gloves
- Field data log sheets/book
- Garmin hand-held DGPS
- Sample labels
- Chain of custodies
- Sample containers for taxonomic vouchers
- 10 percent buffered formalin – voucher samples

For the beam trawl sampling, each sample will include 10-minute tows with the survey vessel towing into the current. Latitude and longitude will be recorded for the start and stop locations for each tow. Trawls will be repeated for a minimum of three replicates at each of the two offshore locations (ZID boundary and Point MacKenzie reference site). All fish collected will be identified, enumerated, and measured with live release back to the receiving water. Due to the small numbers of fish that are expected to be collected during the beam trawling effort, it is not expected that fish will be retained for tissue collections although a few representative fish may be retained for taxonomic vouchers.

Beach seining operations will be performed by two field personnel with one person standing at the waterline holding one end of the seine and a second person wading out with chest waders to approximately 3 to 4 feet of water and pulling the seine to its fullest extent, and then circling back to shore. The seine will then be pursed to collect the fish with the sample deposited into a clean sampling tray for processing. Processing of fish samples collected with the seine will include in-field speciation, enumeration, and measurement of all fish, with live release except for those specimens retained for either bioaccumulation analyses or as taxonomic voucher samples. Fish retained for bioaccumulation analyses will be rinsed with site water to remove visible mud/sediment, wrapped in aluminum foil, placed in double watertight plastic Ziploc® bags, labeled, and immediately chilled in a cooler. Upon returning to shore, all tissue samples will be frozen and remain so until processing at the laboratory.

Because the focus of the bioaccumulation effort will be on prey species for higher trophic levels, tissue analyses will be performed on whole fish rather than on muscle tissue. Due to the small size of individual fish, each sample will consist of multiple fish that will be homogenized by the laboratory into a single composite sample for analysis.

To avoid cross-contamination during fish tissue collections, all equipment used in sampling handling (trays, measuring boards, etc.) will be cleaned before each sample is processed. All surfaces will be cleaned by first rinsing with site water followed by a phosphate free detergent wash, rinsed with potable water, and then rinsed three times with deionized water as described in Section 4.

3.7.5 Data Evaluation

Two composite replicate fish samples from the targeted species will be collected (if possible) from each of the five intertidal stations and analyzed as described previously for the targeted priority pollutants and pesticides. In addition, one of the samples will be analyzed in duplicate by the laboratory for QC purposes. The fish bioaccumulation evaluation will focus on the relative concentrations of each of the targeted pollutants in the whole fish collected from the five monitoring stations. If concentrations at sites near the outfall are significantly higher than those from the control site, the data will be evaluated against published fish tissue literature to assess potential effects on local fish populations.

The potential effects on the biological community resulting from chemical concentrations in the fish tissue can be evaluated by comparing concentrations to benchmark values that indicate potential risk. These tissue-screening concentrations will be used to determine whether the fish tissue concentrations are at levels harmful to marine environments.

Results of the fish community analysis and bioaccumulation study will be presented with tabular summaries that include comparisons between the control and outfall locations for species abundance and distribution as well as tissue bioaccumulation concentrations. Both tabular and graphical presentations will include supporting statistical analysis, where appropriate.

4. Quality Assurance

4.1 Purpose

This section of this QAPP provides QA/QC requirements for sampling activities and field and laboratory analyses for the AWPCF 301(h) waiver and NPDES permit renewal application supplement. The project team will use this document to ensure consistency in data collection and validation. Topics addressed within this section are summarized below:

- Quality Assurance (QA) Objectives
- QA Procedures
- Quality Control (QC)
- Decontamination Procedures
- Sample Custody
- Calibration and Preventive Maintenance
- Field Recordkeeping
- Audits
- Corrective Actions
- Data Management and Validation
- QA Reports

4.2 Quality Assurance Objectives

4.2.1 QA and QC

QA in the context of this study is defined as those established protocols that provide adequate confidence that field activities are planned and performed in accordance with accepted standards and practices to ensure the resulting data are valid. QC is an integral part of the overall QA function and comprises all actions necessary to control and verify that project activities and resulting data meet established requirements.

The level of the supporting QA/QC documentation strengthens data credibility. The greater the importance of the data or the resulting decision, the more QA/QC information is needed to demonstrate data validity. Data must be of sufficient quality to support the AWPCF 301(h) waiver and NPDES permit renewal effort.

Two types of data will be collected under the field program: critical and non-critical. Critical data are essential for meeting project objectives, whereas non-critical data generally support the critical data, but are not used alone for making project decisions. This distinction is necessary when allocating limited resources and budgets, or when addressing time-critical objectives, and/or the environment.

To ensure that a minimum level of data quality is achieved, the following will be done:

- Field operations will be conducted in accordance with standardized field protocols.
- Prior to implementation of the field activities, project staff will be provided with appropriate training to ensure familiarity with the QAPP and any associated documents.
- Internal review will be performed to assess the quality of project activities and to evaluate compliance with established QA requirements.
- QC samples will be used to monitor the quality of field and laboratory data.

4.2.2 Data Quality Objectives

Data Quality Objectives (DQOs) are the qualitative and quantitative statements that specify the quality of data required to support the decision-making process during and following field activities. DQOs are determined prior to field activities based on the final use of the data, and are often expressed using precision, accuracy, representativeness, comparability, and completeness (PARCC) as outlined below:

Precision is the agreement between duplicate results and can be estimated by comparing duplicate matrix spike and duplicate lab control spike recoveries and laboratory duplicate sample results. While field duplicates may also be collected to help estimate homogeneity of sample matrices, these results are not a measure of analytical precision.

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. For organic analyses, each of the samples is spiked with a surrogate spike compound; for inorganic analyses, some QC samples are spiked with a known reference material before digestion. Each of these approaches provides a measure of the matrix effects on the analytical accuracy. Accuracy can be estimated from the analytical data and cannot be measured directly.

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is a subjective parameter and is used to evaluate the efficacy of the sampling plan design. Representativeness is demonstrated by providing full descriptions of the sampling techniques and the rationale used for selecting sampling locations, including control or reference sampling sites, in the project planning documents.

Completeness is defined as the percentage of measurements that are judged to be valid compared to the total number of measurements made. A goal of 95 percent usable data is established in the AWPCF 301(h) data collections.

Comparability is another qualitative measure designed to express the confidence with which one data set may be compared to another. The following factors affect comparability: sample collection and handling techniques, sample matrix type, and analytical method along with MDLs and reporting limits (RLs). Comparability is limited by the other PARCC parameters because data sets can be compared with confidence only when precision and accuracy are known. Data from one phase of an investigation to another can be compared when the same EPA-approved methods are used and data package MDLs, RLs, and deliverables are similar.

4.3 QA Procedures

4.3.1 Analytical QA Procedures

Table 4-1 summarizes the laboratories participating in the project along with specific responsibilities.

Table 4-1. Laboratory Information

Laboratory	Location	Sample Matrix	Specific Responsabilities
KEI	Anchorage, AK	Sampling of receiving water, leachate, sediments, benthic infauna, fish community, and fish tissue	Field sampling of receiving water, leachate, sediments, benthic infauna, fish community, and fish tissue
ALS	Kelso, WA	Receiving water, leachate, tissue, and sediment	General parameters, grain size, metals, PCBs, pesticides, SVOCs, and VOCs (as applicable)
ALS	Houston, TX	Receiving water, tissue, and sediment	Dioxins only
EcoAnalysts	Moscow, ID	Benthic infauna	Taxonomy*

Table 4-1. Laboratory Information

Laboratory	Location	Sample Matrix	Specific Responsabilities
Pacific EcoRisk	Fairfield, CA	Water (influent/leachate)	Toxicity testing

*Benthic sorting and taxonomic analyses will primarily be performed at KEI's Anchorage office, with taxonomic support from EcoAnalysts as required.

4.3.1.1 Analytical Methods

Tables 4-2 through 4-4 summarize the analytical parameters, methods, MDLs, RLs, and accuracy and precision criteria with respect to the chemical analysis of water, sediment, and fish tissue samples, respectively, to be collected as part of this program.

Table 4-2. Analytical and QA/QC Information for Water Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units	Target MDL	Target MRL	% Recovery Accuracy	RPD Precision
Conventionals							
Cyanide, Free	57-12-5	SW-846/9016	mg/L	0.0005	0.01	84-115	20
Cyanide, Total							
Metals							
Antimony	7440-36-0	MET-DIG/200.8	µg/L	0.2	1.0	85-115	20
Arsenic	7440-38-2	1640/200.8/Red Ppt	µg/L	0.06	0.5	71-124	20
Beryllium	7440-41-7	1640/200.8 Red Ppt.	µg/L	0.007	0.02	39-114	20
Cadmium	7440-43-9	1640/200.8 Red Ppt.	µg/L	0.003	0.02	80-114	20
Chromium	7440-47-3	1640/200.8 Red Ppt.	µg/L	0.02	0.2	78-118	20
Copper	7440-50-8	1640/200.8 Red Ppt.	µg/L	0.02	0.1	63-128	20
Lead	7439-92-1	1640/200.8 Red Ppt.	µg/L	0.02	0.05	82-113	20
Mercury	7439-97-6	1631E App./1631E	ng/L	0.06	0.5	77-123	24
Molybdenum	7439-98-7	MET-DIG/200.8	µg/L	0.16	1.0	85-115	20
Nickel	7440-02-0	1640/200.8 Red Ppt.	µg/L	0.03	0.2	88-112	20
Selenium	7782-49-2	MET-DIG/200.8	µg/L	0.2	2.0	85-115	20
Silver	7440-22-4	1640/200.8 Red Ppt.	µg/L	0.004	0.02	80-110	20
Thallium	7440-28-0	1640/200.8 Red Ppt.	µg/L	0.008	0.02	79-110	20
Zinc	7440-66-6	1640/200.8 Red Ppt.	µg/L	0.2	0.5	79-133	20
Dioxin							
2,3,7,8-TCDD	1746-01-6	8290	ug/L	1.84	5	67-158	20
PCBs							
Aroclor 1016	12674-11-2	608.3	ug/L	0.019	0.098	50-140	36
Aroclor 1221	11104-28-2	608.3	ug/L	0.019	0.1	N/A	N/A

Table 4-2. Analytical and QA/QC Information for Water Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units	Target MDL	Target MRL	% Recovery Accuracy	RPD Precision
Aroclor 1232	11141-16-5	608.3	ug/L	0.019	0.1	N/A	N/A
Aroclor 1242	53469-21-9	608.3	ug/L	0.019	0.1	N/A	N/A
Aroclor 1248	12672-29-6	608.3	ug/L	0.019	0.1	N/A	N/A
Aroclor 1254	11097-69-1	608.3	ug/L	0.024	0.1	N/A	N/A
Aroclor 1260	11096-82-5	608.3	ug/L	0.024	0.1	8-140	38
Pesticides							
4,4'-DDD	72-54-8	608.3	ug/L	0.0005	0.01	33-132	30
4,4'-DDE	72-55-9	608.3	ug/L	0.00074	0.01	41-116	30
4,4'-DDT	50-29-3	608.3	ug/L	0.00077	0.01	42-143	30
Aldrin	309-00-2	608.3	ug/L	0.00049	0.01	10-102	30
alpha-Chlordane	5103-71-9	608.3	ug/L	0.00045	0.01	45-115	30
Chlordane	57-74-9	608.3	ug/L	0.029	0.2	45-148	30
Dieldrin	60-57-1	608.3	ug/L	0.00052	0.01	50-115	30
Endosulfan I	959-98-8	608.3	ug/L	0.0032	0.01	35-115	30
Endosulfan II	33213-65-9	608.3	ug/L	0.00088	0.01	28-128	30
Endosulfan Sulfate	1031-07-8	608.3	ug/L	0.00036	0.01	38-118	30
Endrin	72-20-8	608.3	ug/L	0.00053	0.01	48-126	30
Endrin Aldehyde	7421-93-4	608.3	ug/L	0.0051	0.01	27-104	30
Endrin Ketone	53494-70-5	608.3	ug/L	0.00065	0.01	30-124	30
gamma-BHC (Lindane)	58-89-9	608.3	ug/L	0.00067	0.01	44-117	30
Heptachlor	76-44-8	608.3	ug/L	0.00051	0.01	40-115	30
Heptachlor Epoxide	1024-57-3	608.3	ug/L	0.0022	0.01	49-109	30
Methoxychlor	72-43-5	608.3	ug/L	0.0036	0.01	43-143	30
Toxaphene	8001-35-2	608.3	ug/L	0.056	0.5	36-137	30
Azinphos-methyl	86-50-0	3535A/ALS SOP 35353535A3535A/ALS SOP	ng/L	27	100	70-120	30
Demeton-O,S	8065-48-3	3535A/ALS SOP	ng/L	42	150	70-120	30
Ethyl Parathion	56-38-2	3535A/ALS SOP	ng/L	6.9	50	70-120	30
Malathion	121-75-5	3535A/ALS SOP	ng/L	5.1	50	70-120	30
SVOCs							
1,2,4-Trichlorobenzene	120-82-1	625.1	ug/L	0.033	0.8	57-130	30
2,4,6-Trichlorophenol	88-06-2	625.1	ug/L	0.3	0.8	52-129	30
2,4-Dichlorophenol	120-83-2	625.1	ug/L	0.11	0.8	53-122	30

Table 4-2. Analytical and QA/QC Information for Water Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units	Target MDL	Target MRL	% Recovery Accuracy	RPD Precision
2,4-Dimethylphenol	105-67-9	625.1	ug/L	0.2	0.8	42-120	30
2,4-Dinitrophenol	51-28-5	625.1	ug/L	1.8	4.0	0.1-173	30
2,4-Dinitrotoluene	121-14-2	625.1	ug/L	0.19	0.8	48-127	30
2,6-Dinitrotoluene	606-20-2	625.1	ug/L	0.17	0.8	68-137	30
2-Chloronaphthalene	91-58-7	625.1	ug/L	0.038	0.8	65-120	30
2-Chlorophenol	95-57-8	625.1	ug/L	0.057	0.8	36-120	30
2-Nitrophenol	88-75-5	625.1	ug/L	0.086	0.8	45-167	30
3,3'-Dichlorobenzidine	91-94-1	625.1	ug/L	0.089	0.8	8-213	30
4,6-Dinitro-2-methylphenol	534-52-1	625.1	ug/L	1.7	2.0	53-130	30
4-Bromophenyl Phenyl Ether	101-55-3	625.1	ug/L	0.056	0.8	65-120	30
4-Chloro-3-methylphenol	59-50-7	625.1	ug/L	0.18	0.8	41-128	30
4-Chlorophenyl Phenyl Ether	7005-72-3	625.1	ug/L	0.051	0.8	38-145	30
4-Nitrophenol	100-02-7	625.1	ug/L	1.8	2.0	13-129	30
Acenaphthene	83-32-9	625.1	ug/L	0.038	0.8	60-132	30
Acenaphthylene	208-96-8	625.1	ug/L	0.052	0.8	54-126	30
Anthracene	120-12-7	625.1	ug/L	0.12	0.8	43-120	30
Benz(a)anthracene	56-55-3	625.1	ug/L	0.06	0.8	42-133	30
Benzidine	92-87-5	625.1	ug/L	1.9	2.0	60-140	30
Benzo(a)pyrene	50-32-8	625.1	ug/L	0.064	0.8	32-148	30
Benzo(b)fluoranthene	205-99-2	625.1	ug/L	0.055	0.8	42-140	30
Benzo(g,h,i)perylene	191-24-2	625.1	ug/L	0.14	0.8	0.1-195	30
Benzo(k)fluoranthene	207-08-9	625.1	ug/L	0.08	0.8	25-146	30
Bis(1-chloroisopropyl) Ether	108-60-1	625.1	ug/L	0.046	0.8	63-139	30
Bis(2-chloroethoxy) Methane	111-91-1	625.1	ug/L	0.052	0.8	49-165	30
Bis(2-ethylhexyl) Phthalate	117-81-7	625.1	ug/L	0.58	0.8	29-137	30
Butyl Benzyl Phthalate	85-68-7	625.1	ug/L	0.78	0.8	0.1-140	30
Chrysene	218-01-9	625.1	ug/L	0.079	0.8	44-140	30
Dibenz(a,h)anthracene	53-70-3	625.1	ug/L	0.15	0.8	0.1-200	30
Diethyl Phthalate	84-66-2	625.1	ug/L	0.065	0.8	0.1-120	30
Dimethyl Phthalate	131-11-3	625.1	ug/L	0.068	0.8	0.1-120	30
Di-n-butyl Phthalate	84-74-2	625.1	ug/L	0.73	0.8	8-120	30
Di-n-octyl Phthalate	117-84-0	625.1	ug/L	0.14	0.8	19-132	30
Fluoranthene	206-44-0	625.1	ug/L	0.069	0.8	43-121	30

Table 4-2. Analytical and QA/QC Information for Water Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units	Target MDL	Target MRL	% Recovery Accuracy	RPD Precision
Fluorene	86-73-7	625.1	ug/L	0.035	0.8	70-120	30
Hexachlorobenzene	118-74-1	625.1	ug/L	0.041	0.8	8-142	30
Hexachlorobutadiene	87-68-3	625.1	ug/L	0.21	0.8	38-120	30
Hexachloroethane	67-72-1	625.1	ug/L	0.21	0.8	55-120	30
Indeno(1,2,3-cd)pyrene	193-39-5	625.1	ug/L	0.2	0.8	0.1-151	30
Isophorone	78-59-1	625.1	ug/L	0.17	0.8	47-180	30
Naphthalene	91-20-3	625.1	ug/L	0.039	0.8	36-120	30
Nitrobenzene	98-95-3	625.1	ug/L	0.14	0.8	54-158	30
N-Nitrosodi-n-propylamine	621-64-7	625.1	ug/L	0.14	0.8	14-198	30
Pentachlorophenol (PCP)	87-86-5	625.1	ug/L	0.49	2.0	38-152	30
Phenanthrene	85-01-8	625.1	ug/L	0.034	0.8	65-120	30
Phenol	108-95-2	625.1	ug/L	0.022	0.8	17-120	30
Pyrene	129-00-0	625.1	ug/L	0.09	0.8	70-120	30
VOCs							
1,1,1-Trichloroethane (TCA)	71-55-6	624.1	ug/L	5	0.07	70-130	21
1,1,2,2-Tetrachloroethane	79-34-5	624.1	ug/L	5	0.08	60-140	36
1,1,2-Trichloroethane	79-00-5	624.1	ug/L	5	0.06	70-130	27
1,1,2-Trichlorotrifluoroethane	76-13-1	624.1	ug/L	5	0.07	65-153	30
1,1-Dichloroethane (1,1-DCA)	75-34-3	624.1	ug/L	5	0.07	70-130	24
1,1-Dichloroethene (1,1-DCE)	75-35-4	624.1	ug/L	5	0.08	50-150	40
1,2-Dichlorobenzene	95-50-1	624.1	ug/L	5	0.06	65-135	31
1,2-Dichloropropane	78-87-5	624.1	ug/L	5	0.07	35-165	69
1,3-Dichlorobenzene	541-73-1	624.1	ug/L	5	0.06	70-130	24
1,4-Dichlorobenzene	106-46-7	624.1	ug/L	5	0.09	65-135	30
2-Chloroethyl Vinyl Ether	110-75-8	624.1	ug/L	10	0.2	5-225	130
2-Hexanone	591-78-6	624.1	ug/L	20	0.8	37-136	30
4-Methyl-2-pentanone	108-10-1	624.1	ug/L	20	2.0	46-129	30
Acrolein	107-02-8	624.1	ug/L	50	2.0	60-140	30
Acrylonitrile	107-13-1	624.1	ug/L	100	0.2	60-140	30
Benzene	71-43-2	624.1	ug/L	5	0.06	65-135	33
Bromodichloromethane	75-27-4	624.1	ug/L	5	0.2	65-135	34
Bromoform	75-25-2	624.1	ug/L	5	0.4	70-130	25
Bromomethane	74-83-9	624.1	ug/L	5	0.09	15-185	90

Table 4-2. Analytical and QA/QC Information for Water Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units	Target MDL	Target MRL	% Recovery Accuracy	RPD Precision
Carbon Disulfide	75-15-0	624.1	ug/L	5	0.2	70-130	30
Carbon Tetrachloride	56-23-5	624.1	ug/L	5	0.2	70-130	26
Chlorobenzene	108-90-7	624.1	ug/L	5	0.05	65-135	29
Chloroethane	75-00-3	624.1	ug/L	5	0.1	40-160	47
Chloroform	67-66-3	624.1	ug/L	5	0.07	70-135	32
Chloromethane	74-87-3	624.1	ug/L	5	0.06	5-205	472
cis-1,2-Dichloroethene	156-59-2	624.1	ug/L	5	0.05	80-124	30
cis-1,3-Dichloropropene	10061-01-5	624.1	ug/L	5	0.09	25-175	79
Dibromochloromethane	124-48-1	624.1	ug/L	5	0.2	70-135	30
Dibromomethane	74-95-3	624.1	ug/L	5	0.07	70-130	30
Dichlorodifluoromethane (CFC) 12)	75-71-8	624.1	ug/L	5	0.1	32-158	30
Dichloromethane	75-09-2	624.1	ug/L	5	0.3	60-140	192
Ethylbenzene	100-41-4	624.1	ug/L	5	0.03	60-140	34
m,p-Xylenes	179601-23-1	624.1	ug/L	5	0.1	70-130	30
o-Xylene	95-47-6	624.1	ug/L	5	0.05	70-130	30
Styrene	100-42-5	624.1	ug/L	5	0.05	80-120	30
Tetrachloroethene (PCE)	127-18-4	624.1	ug/L	5	0.05	70-130	23
Toluene	108-88-3	624.1	ug/L	5	0.07	70-130	22
trans-1,2-Dichloroethene	156-60-5	624.1	ug/L	5	0.07	70-130	27
trans-1,3-Dichloropropene	10061-02-6	624.1	ug/L	5	0.09	50-150	52
Trichloroethene (TCE)	79-01-6	624.1	ug/L	5	0.08	65-135	29
Trichlorofluoromethane (CFC 11)	75-69-4	624.1	ug/L	5	0.07	50-150	50
Vinyl Acetate	108-05-4	624.1	ug/L	10	0.3	62-141	30
Vinyl Chloride	75-01-4	624.1	ug/L	5	0.09	5-195	100

CAS = Chemical Abstracts Service Registry Number; N/A = not applicable; RPD = relative percent difference; Red Ppt = reduction preparation; SOP = standard operating procedure.

Table 4-3. Analytical and QA/QC Information for Sediment Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
Conventionals							
Particle Grain Size	N/A	D422M	%	N/A	0.1	N/A	N/A
Solids, Total	N/A	160.3 Mod	%	N/A	N/A	N/A	20

Table 4-3. Analytical and QA/QC Information for Sediment Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
TVS	N/A	2540G	%	N/A	0.1	N/A	20
Cyanide, Total	57-12-5	9012	mg/kg	0.06	0.2	62-128	20
TOC	7440-44-0	D4129-05	%	0.02	0.05	72-122	20
Metals							
Antimony	7440-36-0	3050B/6020A	mg/kg	0.02	0.05	50-150	20
Arsenic	7440-38-2	3050B/6020A	mg/kg	0.06	0.5	78-122	20
Beryllium	7440-41-7	3050B/6020A	mg/kg	0.006	0.02	83-117	20
Cadmium	7440-43-9	3050B/6020A	mg/kg	0.007	0.02	81-119	20
Chromium	7440-47-3	3050B/6020A	mg/kg	0.06	0.2	80-119	20
Copper	7440-50-8	3050B/6020A	mg/kg	0.04	0.1	83-116	20
Lead	7439-92-1	3050B/6020A	mg/kg	0.02	0.05	79-121	20
Mercury	7439-97-6	1631E App/1631E	µg/kg	0.09	1.0	70-130	20
Molybdenum	7439-98-7	3050B/6020A	mg/kg	0.02	0.05	75-125	20
Nickel	7440-02-0	3050B/6020A	mg/kg	0.03	0.2	81-118	20
Selenium	7782-49-2	3050B/6020A	mg/kg	0.09	1.0	74-143	20
Silver	7440-22-4	3050B/6020A	mg/kg	0.004	0.02	81-129	20
Thallium	7440-28-0	3050B/6020A	mg/kg	0.004	0.02	79-120	20
Zinc	7440-66-6	3050B/6020A	mg/kg	0.2	0.5	73-121	20
Dioxin							
2,3,7,8-TCDD	1746-01-6	8290	ng/kg	0.119	0.5	67-158	20
PCBs							
Aroclor 1016	12674-11-2	3541/8082A	mg/kg	0.0085	0.10	42-122	40
Aroclor 1221	11104-28-2	3541/8082A	mg/kg	0.0085	0.20	N/A-	N/A
Aroclor 1232	11141-16-5	3541/8082A	mg/kg	0.0085	0.10	N/A	N/A
Aroclor 1242	53469-21-9	3541/8082A	mg/kg	0.0085	0.10	N/A	N/A
Aroclor 1248	12672-29-6	3541/8082A	mg/kg	0.0085	0.10	N/A	N/A
Aroclor 1254	11097-69-1	3541/8082A	mg/kg	0.0085	0.10	N/A	N/A
Aroclor 1260	11096-82-5	3541/8082A	mg/kg	0.0085	0.10	50-124	40
Pesticides							
4,4'-DDD	72-54-8	8081B	µg/kg	0.1	1.0	37-136	40
4,4'-DDE	72-55-9	8081B	µg/kg	0.085	1.0	42-137	40
4,4'-DDT	50-29-3	8081B	µg/kg	0.078	1.0	42-137	40
Aldrin	309-00-2	8081B	µg/kg	0.056	1.0	33-123	40

Table 4-3. Analytical and QA/QC Information for Sediment Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
alpha-Chlordane	5103-71-9	8081B	µg/kg	0.063	1.0	34-128	40
Chlordane	57-74-9	8081B	µg/kg	3.1	10	35-131	40
Dieldrin	60-57-1	8081B	µg/kg	0.083	1.0	39-130	40
Endosulfan I	959-98-8	8081B	µg/kg	0.06	1.0	31-115	40
Endosulfan II	33213-65-9	8081B	µg/kg	0.091	1.0	34-120	40
Endosulfan Sulfate	1031-07-8	8081B	µg/kg	0.051	1.0	35-129	40
Endrin	72-20-8	8081B	µg/kg	0.057	1.0	31-140	40
Endrin Aldehyde	7421-93-4	8081B	µg/kg	0.061	1.0	25-127	40
Endrin Ketone	53494-70-5	8081B	µg/kg	0.076	1.0	41-130	40
gamma-BHC (Lindane)	58-89-9	8081B	µg/kg	0.051	1.0	34-134	40
gamma-Chlordane	5566-34-7	8081B	µg/kg	0.072	1.0	34-128	40
Heptachlor	76-44-8	8081B	µg/kg	0.055	1.0	35-136	40
Heptachlor Epoxide	1024-57-3	8081B	µg/kg	0.23	1.0	40-116	40
Methoxychlor	72-43-5	8081B	µg/kg	0.15	1.0	40-135	40
Mirex	2385-85-5	8081B	µg/kg	0.63	1.0	33-111	40
Toxaphene	8001-35-2	8081B	µg/kg	14	50	41-132	40
Azinphos-methyl	86-50-0	3541/ALS SOP GC/MS/MS	µg/kg	4.109	10	70-120	40
Demeton-O,S	8065-48-3	3541/ALS SOP GC/MS/MS	µg/kg	2.16	5	70-120	40
Ethyl Parathion	56-38-2	3541/ALS SOP GC/MS/MS	µg/kg	1.856	5	70-120	40
Malathion	121-75-5	3541/ALS SOP GC/MS/MS	µg/kg	1.998	5	70-120	40
SVOCs							
1,2,4-Trichlorobenzene	120-82-1	3541/8270D	µg/kg	2.6	10	30-75	40
2,4,6-Trichlorophenol	88-06-2	3541/8270D	µg/kg	3	10	33-79	40
2,4-Dichlorophenol	120-83-2	3541/8270D	µg/kg	2.6	10	32-77	40
2,4-Dimethylphenol	105-67-9	3541/8270D	µg/kg	6.3	50	21-87	40
2,4-Dinitrophenol	51-28-5	3541/8270D	µg/kg	29	200	14-94	40
2,4-Dinitrotoluene	121-14-2	3541/8270D	µg/kg	2.5	10	35-93	40
2,6-Dinitrotoluene	606-20-2	3541/8270D	µg/kg	2.9	10	36-84	40
2-Chloronaphthalene	91-58-7	3541/8270D	µg/kg	3.2	10	32-74	40
2-Chlorophenol	95-57-8	3541/8270D	µg/kg	3	10	30-72	40
2-Methyl-4,6-dinitrophenol	534-52-1	3541/8270D	µg/kg	39	100	26-104	40

Table 4-3. Analytical and QA/QC Information for Sediment Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
2-Nitrophenol	88-75-5	3541/8270D	µg/kg	4	10	30-79	40
3,3'-Dichlorobenzidine	91-94-1	3541/8270D	µg/kg	4.1	100	43-99	40
4-Bromophenyl Phenyl Ether	101-55-3	3541/8270D	µg/kg	3.1	10	35-85	40
4-Chloro-3-methylphenol	59-50-7	3541/8270D	µg/kg	2.9	10	26-88	40
4-Chlorophenyl Phenyl Ether	7005-72-3	3541/8270D	µg/kg	3.2	10	32-79	40
4-Nitrophenol	100-02-7	3541/8270D	µg/kg	7.7	100	19-116	40
Acenaphthene	83-32-9	3541/8270D	µg/kg	3.2	10	21-77	40
Acenaphthylene	208-96-8	3541/8270D	µg/kg	2.6	10	30-79	40
Anthracene	120-12-7	3541/8270D	µg/kg	3.2	10	36-87	40
Benz(a)anthracene	56-55-3	3541/8270D	µg/kg	3.6	10	43-98	40
Benzo(a)pyrene	50-32-8	3541/8270D	µg/kg	3.6	10	43-102	40
Benzo(b)fluoranthene	205-99-2	3541/8270D	µg/kg	3.4	10	39-99	40
Benzo(g,h,i)perylene	191-24-2	3541/8270D	µg/kg	3.7	10	39-99	40
Benzo(k)fluoranthene	207-08-9	3541/8270D	µg/kg	4	10	38-93	40
Bis(2-chloroethoxy)methane	111-91-1	3541/8270D	µg/kg	2.8	10	30-77	40
2,2'-Oxybis(1-chloropropane)	108-60-1	3541/8270D	µg/kg	2.8	10	22-77	40
Bis(2-ethylhexyl) Phthalate	117-81-7	3541/8270D	µg/kg	8.9	100	39-113	40
Butyl Benzyl Phthalate	85-68-7	3541/8270D	µg/kg	3.7	10	13-103	40
Chrysene	218-01-9	3541/8270D	µg/kg	4.1	10	41-98	40
Dibenz(a,h)anthracene	53-70-3	3541/8270D	µg/kg	3	10	38-101	40
Diethyl Phthalate	84-66-2	3541/8270D	µg/kg	3.7	10	35-95	40
Dimethyl Phthalate	131-11-3	3541/8270D	µg/kg	4	10	36-85	40
Di-n-butyl Phthalate	84-74-2	3541/8270D	µg/kg	4.8	20	30-120	40
Di-n-octyl Phthalate	117-84-0	3541/8270D	µg/kg	3.2	10	41-115	40
Fluoranthene	206-44-0	3541/8270D	µg/kg	3.7	10	25-115	40
Fluorene	86-73-7	3541/8270D	µg/kg	3.3	10	30-81	40
Hexachlorobenzene	118-74-1	3541/8270D	µg/kg	3.3	10	36-86	40
Hexachlorobutadiene	87-68-3	3541/8270D	µg/kg	3	10	30-79	40
Hexachloroethane	67-72-1	3541/8270D	µg/kg	2.5	10	23-76	40
Indeno(1,2,3-cd)pyrene	193-39-5	3541/8270D	µg/kg	3.2	10	36-105	40
Isophorone	78-59-1	3541/8270D	µg/kg	2.8	10	31-79	40
Naphthalene	91-20-3	3541/8270D	µg/kg	2.9	10	30-74	40
Nitrobenzene	98-95-3	3541/8270D	µg/kg	3.4	10	28-78	40

Table 4-3. Analytical and QA/QC Information for Sediment Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
N-Nitrosodi-n-propylamine	621-64-7	3541/8270D	µg/kg	3.3	10	25-79	40
Pentachlorophenol	87-86-5	3541/8270D	µg/kg	5.3	100	19-103	40
Phenanthrene	85-01-8	3541/8270D	µg/kg	3.6	10	36-85	40
Phenol	108-95-2	3541/8270D	µg/kg	3.1	30	27-75	40
Pyrene	129-00-0	3541/8270D	µg/kg	3.7	10	40-99	40
VOCs							
1,1,1-Trichloroethane (TCA)	71-55-6	5035A/8260C	µg/kg	0.11	5.0	59-146	40
1,1,2,2-Tetrachloroethane	79-34-5	5035A/8260C	µg/kg	0.13	5.0	60-128	40
1,1,2-Trichloroethane	79-00-5	5035A/8260C	µg/kg	0.15	5.0	72-118	40
1,1-Dichloroethane	75-34-3	5035A/8260C	µg/kg	0.12	5.0	59-137	40
1,1-Dichloroethene	75-35-4	5035A/8260C	µg/kg	0.25	5.0	64-152	40
1,2-Dichlorobenzene	95-50-1	5035A/8260C	µg/kg	0.077	5.0	67-124	40
1,2-Dichloroethane (EDC)	107-06-2	5035A/8260C	µg/kg	0.07	5.0	65-121	40
1,2-Dichloropropane	78-87-5	5035A/8260C	µg/kg	0.13	5.0	71-121	40
1,3-Dichlorobenzene	541-73-1	5035A/8260C	µg/kg	0.094	5.0	69-128	40
1,4-Dichlorobenzene	106-46-7	5035A/8260C	µg/kg	0.086	5.0	69-125	40
2-Chloroethyl Vinyl Ether	110-75-8	5035A/8260C	µg/kg	0.43	10	63-130	40
2-Hexanone	591-78-6	5035A/8260C	µg/kg	0.93	20	67-121	40
4-Methyl-2-pentanone (MIBK)	108-10-1	5035A/8260C	µg/kg	1.8	20	69-126	40
Acrolein	107-02-8	5035A/8260C	µg/kg	1.7	100	10-218	40
Acrylonitrile	107-13-1	5035A/8260C	µg/kg	0.43	20	18-179	40
Benzene	71-43-2	5035A/8260C	µg/kg	0.054	5.0	68-122	40
Bromodichloromethane	75-27-4	5035A/8260C	µg/kg	0.16	5.0	61-143	40
Bromoform	75-25-2	5035A/8260C	µg/kg	0.14	5.0	62-134	40
Bromomethane	74-83-9	5035A/8260C	µg/kg	0.2	5.0	22-180	40
Carbon Disulfide	75-15-0	5035A/8260C	µg/kg	0.092	5.0	55-141	40
Carbon Tetrachloride	56-23-5	5035A/8260C	µg/kg	0.094	5.0	51-135	40
Chlorobenzene	108-90-7	5035A/8260C	µg/kg	0.065	5.0	70-116	40
Chloroethane	75-00-3	5035A/8260C	µg/kg	0.74	5.0	51-122	40
Chloroform	67-66-3	5035A/8260C	µg/kg	0.11	5.0	61-137	40
Chloromethane	74-87-3	5035A/8260C	µg/kg	0.18	5.0	37-146	40
cis-1,2-Dichloroethene	156-59-2	5035A/8260C	µg/kg	0.12	5.0	62-138	40
cis-1,3-Dichloropropene	10061-01-5	5035A/8260C	µg/kg	0.13	5.0	58-138	40

Table 4-3. Analytical and QA/QC Information for Sediment Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
Dibromochloromethane	124-48-1	5035A/8260C	µg/kg	0.18	5.0	69-120	40
Dichlorodifluoromethane	75-71-8	5035A/8260C	µg/kg	0.12	5.0	38-160	40
Ethylbenzene	100-41-4	5035A/8260C	µg/kg	0.094	5.0	70-118	40
m,p-Xylenes	179601-23-1	5035A/8260C	µg/kg	0.1	5.0	69-127	40
Methylene Chloride	75-09-2	5035A/8260C	µg/kg	0.16	10	65-122	40
o-Xylene	95-47-6	5035A/8260C	µg/kg	0.081	5.0	69-124	40
Styrene	100-42-5	5035A/8260C	µg/kg	0.14	5.0	62-135	40
Tetrachloroethene (PCE)	127-18-4	5035A/8260C	µg/kg	0.16	5.0	66-126	40
Toluene	108-88-3	5035A/8260C	µg/kg	0.15	5.0	75-117	40
trans-1,2-Dichloroethene	156-60-5	5035A/8260C	µg/kg	0.12	5.0	63-127	40
trans-1,3-Dichloropropene	10061-02-6	5035A/8260C	µg/kg	0.11	5.0	63-121	40
Trichloroethene (TCE)	79-01-6	5035A/8260C	µg/kg	0.15	5.0	67-126	40
Trichlorofluoromethane	75-69-4	5035A/8260C	µg/kg	0.085	5.0	51-140	40
Trichlorotrifluoroethane	76-13-1	5035A/8260C	µg/kg	0.24	5.0	53-135	40
Vinyl Acetate	108-05-4	5035A/8260C	µg/kg	0.31	20	45-158	40
Vinyl Chloride	75-01-4	5035A/8260C	µg/kg	0.18	5.0	54-127	40

µg/kg = micrograms per kilogram; mg/kg = milligrams per kilogram; ng/kg = nanograms per kilogram.

Table 4-4. Analytical and QA/QC Information for Tissue Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction Method)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
Conventionals							
Solids, Total	N/A	160.3 Mod	%	N/A	N/A	**N/A**	20
Metals							
Antimony	7440-36-0	PSEP/6020A	mg/kg	0.002	0.05	75-125	20
Arsenic	7440-38-2	PSEP/6020A	mg/kg	0.02	0.5	75-125	20
Beryllium	7440-41-7	PSEP/6020A	mg/kg	0.003	0.02	75-125	20
Cadmium	7440-43-9	PSEP/6020A	mg/kg	0.002	0.02	75-125	20
Chromium	7440-47-3	PSEP/6020A	mg/kg	0.02	0.2	75-125	20
Copper	7440-50-8	PSEP/6020A	mg/kg	0.02	0.1	75-125	20
Lead	7439-92-1	PSEP/6020A	mg/kg	0.0005	0.02	75-125	20

Table 4-4. Analytical and QA/QC Information for Tissue Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction Method)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
Mercury	7439-97-6	1631E App/1631E App/1631E Appendix	ug/kg	0.09	1.0	70-130	20
Molybdenum	7439-98-7	PSEP/6020A	mg/kg	0.008	0.05	75-125	20
Nickel	7440-02-0	PSEP/6020A	mg/kg	0.02	0.2	75-125	20
Selenium	7782-49-2	PSEP/6020A	mg/kg	0.2	1.0	75-125	20
Silver	7440-22-4	PSEP/6020A	mg/kg	0.006	0.02	75-125	20
Thallium	7440-28-0	PSEP/6020A	mg/kg	0.0009	0.02	75-125	20
Zinc	7440-66-6	PSEP/6020A	mg/kg	0.06	0.5	75-125	20
Dioxin							
2,3,7,8-TCDD	1746-01-6	8290	ng/kg	0.513	0.5	67-158	20
PCBs							
Aroclor 1016	12674-11-2	8082A	µg/kg	2.8	10	46-128	40
Aroclor 1221	11104-28-2	8082A	µg/kg	2.8	10	N/A	N/A
Aroclor 1232	11141-16-5	8082A	µg/kg	2.8	10	N/A	N/A
Aroclor 1242	53469-21-9	8082A	µg/kg	2.8	10	N/A	N/A
Aroclor 1248	12672-29-6	8082A	µg/kg	2.8	10	N/A	N/A
Aroclor 1254	11097-69-1	8082A	µg/kg	2.8	10	N/A	N/A
Aroclor 1260	11096-82-5	8082A	µg/kg	2.8	10	46-128	40
Pesticides							
4,4'-DDD	72-54-8	3546/8081B	µg/kg	0.41	1.0	70-130	40
4,4'-DDE	72-55-9	3546/8081B	µg/kg	0.45	1.0	70-130	40
4,4'-DDT	50-29-3	3546/8081B	µg/kg	0.49	1.0	70-130	40
Aldrin	309-00-2	3546/8081B	µg/kg	0.19	1.0	70-130	40
alpha-Chlordane	5103-71-9	3546/8081B	µg/kg	0.24	1.0	70-130	40
Chlordane	57-74-9	3546/8081B	µg/kg	3.1	10	70-130	40
Dieldrin	60-57-1	3546/8081B	µg/kg	0.23	1.0	70-130	40
Endosulfan I	959-98-8	3546/8081B	µg/kg	0.28	1.0	70-130	40
Endosulfan II	33213-65-9	3546/8081B	µg/kg	0.30	1.0	70-130	40
Endosulfan Sulfate	1031-07-8	3546/8081B	µg/kg	0.25	1.0	70-130	40
Endrin	72-20-8	3546/8081B	µg/kg	0.21	1.0	70-130	40
Endrin Aldehyde	7421-93-4	3546/8081B	µg/kg	0.40	1.0	70-130	40
Endrin Ketone	53494-70-5	3546/8081B	µg/kg	0.34	1.0	70-130	40
gamma-BHC (Lindane)	58-89-9	3546/8081B	µg/kg	0.21	1.0	70-130	40

Table 4-4. Analytical and QA/QC Information for Tissue Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction Method)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
gamma-Chlordane	5566-34-7	3546/8081B	µg/kg	0.20	1.0	70-130	40
Heptachlor	76-44-8	3546/8081B	µg/kg	0.13	1.0	70-130	40
Heptachlor Epoxide	1024-57-3	3546/8081B	µg/kg	0.28	1.0	70-130	40
Methoxychlor	72-43-5	3546/8081B	µg/kg	0.61	1.0	70-130	40
Mirex	2385-85-5	3546/8081B	µg/kg	0.24	1.0	70-130	40
Toxaphene	8001-35-2	3546/8081B	µg/kg	9.3	50	70-130	40
Azinphos-methyl	86-50-0	3541/ALS SOP	µg/kg	17	40	70-120	40
Demeton-O,S	8065-48-3	3541/ALS SOP	µg/kg	14	40	70-120	40
Ethyl Parathion	56-38-2	3541/ALS SOP	µg/kg	18	40	70-120	40
Malathion	121-75-5	3541/ALS SOP	µg/kg	11	40	70-120	40
SVOCs							
1,2,4-Trichlorobenzene	120-82-1	3541/8270D	µg/kg	2.8	40	36-119	40
2,4,6-Trichlorophenol	88-06-2	3541/8270D	µg/kg	7.3	40	47-120	40
2,4-Dichlorophenol	120-83-2	3541/8270D	µg/kg	11	40	47-117	40
2,4-Dimethylphenol	105-67-9	3541/8270D	µg/kg	8.3	40	10-101	40
2,4-Dinitrophenol	51-28-5	3541/8270D	µg/kg	310	2000	40-172	40
2,4-Dinitrotoluene	121-14-2	3541/8270D	µg/kg	6.5	2000	54-109	40
2,6-Dinitrotoluene	606-20-2	3541/8270D	µg/kg	9.3	2000	60-117	40
2-Chloronaphthalene	91-58-7	3541/8270D	µg/kg	3.5	40	70-130	40
2-Chlorophenol	95-57-8	3541/8270D	µg/kg	11	40	63-106	40
2-Methyl-4,6-dinitrophenol	534-52-1	3541/8270D	µg/kg	330	2000	46-119	40
2-Nitrophenol	88-75-5	3541/8270D	µg/kg	9.0	40	37-135	40
3,3'-Dichlorobenzidine	91-94-1	3541/8270D	µg/kg	2000	2000	70-130	40
4-Bromophenyl Phenyl Ether	101-55-3	3541/8270D	µg/kg	3.1	40	42-118	40
4-Chloro-3-methylphenol	59-50-7	3541/8270D	µg/kg	6.8	40	44-123	40
4-Chlorophenyl Phenyl Ether	7005-72-3	3541/8270D	µg/kg	3.4	40	42-114	40
4-Nitrophenol	100-02-7	3541/8270D	µg/kg	17	40	51-154	40
Acenaphthene	83-32-9	3541/8270D	µg/kg	4.4	40	46-122	40
Acenaphthylene	208-96-8	3541/8270D	µg/kg	3.6	40	52-124	40
Anthracene	120-12-7	3541/8270D	µg/kg	4.9	40	70-130	40
Benz(a)anthracene	56-55-3	3541/8270D	µg/kg	2.7	40	50-119	40
Benzo(a)pyrene	50-32-8	3541/8270D	µg/kg	3.2	40	50-119	40
Benzo(b)fluoranthene	205-99-2	3541/8270D	µg/kg	3.8	40	53-108	40

Table 4-4. Analytical and QA/QC Information for Tissue Sample Analysis

Parameter	CAS	Method (with Preparation or Extraction Method)	Units (Dry Weight)	Target MDL	Target MRL	% Recovery Accuracy	% RPD Precision
Benzo(g,h,i)perylene	191-24-2	3541/8270D	µg/kg	2.8	40	52-118	40
Benzo(k)fluoranthene	207-08-9	3541/8270D	µg/kg	4.7	40	51-119	40
Bis(2-chloroethoxy)methane	111-91-1	3541/8270D	µg/kg	2.2	40	63-113	40
2,2'-Oxybis(1-chloropropane)	108-60-1	3541/8270D	µg/kg	15	40	59-117	40
Bis(2-ethylhexyl) Phthalate	117-81-7	3541/8270D	µg/kg	12	2000	56-136	40
Butyl Benzyl Phthalate	85-68-7	3541/8270D	µg/kg	7.9	40	44-141	40
Chrysene	218-01-9	3541/8270D	µg/kg	3.0	40	55-117	40
Dibenz(a,h)anthracene	53-70-3	3541/8270D	µg/kg	4.1	40	52-125	40
Diethyl Phthalate	84-66-2	3541/8270D	µg/kg	140	200	63-124	40
Dimethyl Phthalate	131-11-3	3541/8270D	µg/kg	2.5	40	62-119	40
Di-n-butyl Phthalate	84-74-2	3541/8270D	µg/kg	8.2	100	45-145	40
Di-n-octyl Phthalate	117-84-0	3541/8270D	µg/kg	5.2	40	51-145	40
Fluoranthene	206-44-0	3541/8270D	µg/kg	9.4	40	57-120	40
Fluorene	86-73-7	3541/8270D	µg/kg	4.7	40	54-118	40
Hexachlorobenzene	118-74-1	3541/8270D	µg/kg	3.1	40	63-112	40
Hexachlorobutadiene	87-68-3	3541/8270D	µg/kg	2.4	40	56-105	40
Hexachloroethane	67-72-1	3541/8270D	µg/kg	5.4	40	34-118	40
Indeno(1,2,3-cd)pyrene	193-39-5	3541/8270D	µg/kg	2.7	40	57-121	40
Isophorone	78-59-1	3541/8270D	µg/kg	4.5	40	59-109	40
Naphthalene	91-20-3	3541/8270D	µg/kg	3.4	40	41-111	40
Nitrobenzene	98-95-3	3541/8270D	µg/kg	4.3	40	60-120	40
N-Nitrosodi-n-propylamine	621-64-7	3541/8270D	µg/kg	14	40	50-123	40
Pentachlorophenol	87-86-5	3541/8270D	µg/kg	7.6	100	41-105	40
Phenanthrene	85-01-8	3541/8270D	µg/kg	2.4	40	48-118	40
Phenol	108-95-2	3541/8270D	µg/kg	19	2000	46-126	40
Pyrene	129-00-0	3541/8270D	µg/kg	3.9	40	50-114	40

4.3.1.2 Determination of Method Detection Limits and Analysis of Standard Reference Materials

Information pertaining to the determination of laboratory MDLs and RLs is included in the respective laboratory quality assurance manuals (QAMs). The QAMs for ALS Laboratories and Pacific EcoRisk are included in Appendix A of this QAPP.

Supporting documentation from the laboratories on MDL determinations for the parameters monitored under this program will be provided upon request.

The analytical chemistry laboratory (ALS) analyzes standard reference materials on an annual and project specific basis. Supporting documentation providing the results of the standard reference material analyses will be provided upon request. The toxicity testing laboratory (Pacific EcoRisk) also maintains records on control test performance and these records will be provided upon request.

4.3.1.3 Performance Evaluations Studies and Certifications

ALS takes part in EPA's NPDES and various State Performance Evaluation Studies on a quarterly and annual basis as required and holds relevant certifications for their analytical laboratories that will be provided upon request.

4.3.2 Biological QA Procedures

QA procedures for collecting and analyzing benthic infauna and fish community samples will be consistent with those outlined in *Quality Assurance/Quality Control (QA/QC) for 301(h) Monitoring Programs: Guidance on Field and Analytical Methods* (EPA, 1987). Activities relevant to the benthic infauna community sampling will include the following:

- Establishing minimum grab sample quality "screening" criteria
- Careful inspection of sieves to ensure no mesh deviations from that specified
- Use of filtered ambient water for all sample sieving/transfer
- Double coarse pick/sort of 5 to 10 percent of the trays in the laboratory by different analysts
- Sample fixation immediately following transfer to the container; minimize exposure to sunlight and temperature extremes
- Use of both internal and external sample labels; transfer of internal labels with the sample during the course of laboratory analyses
- Development of a taxonomic reference collection for the study area; submittal of selected specimens to a qualified expert for confirmation of problematic identifications

Activities relevant to the fish community sampling will include the following:

- Establishing fish measurements and weighing procedures and handling criteria
- Establishing taxonomic identification procedures and lead scientists to confirm identifications
- Referencing fish sample fixation immediately following transfer to the container; minimizing exposure to sunlight and temperature extremes
- Use of both internal and external sample labels; transfer of internal labels with the sample during the course of laboratory analyses
- Development of a taxonomic reference collection for the study area; submittal of selected specimens to a qualified expert for confirmation of problematic identifications, if needed

4.3.3 Field Sampling and Monitoring QA Procedures

QA procedures for the field sampling and monitoring include the following elements:

- Prior to daily sampling activities, work area surfaces on board the survey vessel are cleaned thoroughly to prevent cross-contamination of samples
- Prior to the commencement of any equipment decontamination and sampling on board the survey vessel, the vessel is oriented into the wind, if possible, to prevent any exhaust emissions from entering the aft deck work area that could contaminate samples
- All decontaminated sampling equipment, trays, and sample utensils and containers are checked to ensure they are packaged and stored to prevent contamination before sampling commences

4.4 QC Procedures

4.4.1 Laboratory QC

Laboratory QC checks will be performed by the laboratories to assess the validity of the analytical results. The types of laboratory control checks to be performed under this program are summarized in Table 4-5.

Table 4-5. Summary of Laboratory QC Checks

					Calibration[e]		
Parameter	Method Blanks[a]	Duplicates[b]	MS/MSD or LCS/LCSD[c]	Surrogates[d]	Blank	Initial[f]	Continuing
Cyanide	✓	✓	✓				
Particle Grain Size		✓					
Total Solids		✓					
TVS	✓	✓					
TOC		✓					
Metals	✓	✓	✓				
Dioxin	✓	✓	✓	✓	✓	✓	✓
PCBs	✓	✓	✓	✓	✓	✓	✓
Pesticides	✓	✓	✓	✓	✓	✓	✓
SVOCs	✓	✓	✓	✓	✓	✓	✓
VOCs	✓	✓	✓	✓	✓	✓	✓

[a]Method blanks will be performed at a rate of one per batch (typically at a rate of 5% or more).

[b]Duplicates will be performed at a rate of 5 percent if sample volumes allow; MSDs and LCSDs may also be used for replication.

[c]MS/MSDs will be performed at a rate of 5 percent or one per batch if allowed based on available sample volumes. LCS/LCSDs may be substituted or if in adequate sample volume exists. MSDs may be used for replication.

[d]Surrogate spikes for organics analyses are required for every sample, including QC samples.

[e]Ongoing calibration is required at the beginning of each work shift, every 12 hours, and at the end of each shift.

[f]Initial calibrationsare required prior to sample analysis, after each major disruption of equipment, and when ongoing calibration fails criteria.

LCS/LCSDs = laboratory control sample/laboratory control sample duplicate; MS/MSD = matrix spike/matrix spike duplicate.

QA/QC samples will be analyzed by the laboratories in accordance with procedures outlined in their QAMs. Each analytical laboratory will prepare a detailed case narrative outlining QA/QC concerns and corrective action taken for each data set and will attach a QA/QC narrative report to each data report.

4.4.2 Field QC Checks

Field QC samples will be collected during the program to provide data to evaluate QC in regard to sample collection and handling. Under this program, the following field control samples will be collected: field duplicates, field blanks, and equipment blanks. A description of each field QC sample is provided in Table 4-6, along with applicable matrices and collection frequency.

Table 4-6. Summary of Field QC Check Samples

Type	Sample Matrix	Definition	Frequency
Trip Blank	Water VOC Only	A trip blank sample is designed to detect contamination of environmental samples during transport from the field to the lab when sampling for volatile organics. A trip blank is a VOC sample bottle filled with laboratory-analyte-free water, transported to the site, handled like a sample, and returned to the laboratory for analysis. Trip blanks shall not be opened in the field.	One trip blank shall accompany every cooler of water samples sent to the laboratory for the analysis of VOCs. This blank shall be analyzed for VOCs only.
Field Blank	Water	A field blank is designed to evaluate onsite environmental contamination, the purity of reagents used as preservatives, and the sampling container filling/collection techniques. Field blanks are prepared using deionized water collected directly into the sample bottle and will be handled like a sample and transported to a laboratory for analysis.	Field blank(s) will be taken at a rate of 5 percent of the total number of samples collected. This blank will be analyzed for all laboratory analyses requested where applicable for environmental samples collected at the site.
Equipment Blank	Sediment	An equipment blank is designed to detect contamination of environmental samples caused by contamination of sampling equipment. An equipment blank is analyte-free water that is poured into or pumped through the sampling device, transferred to a sample bottle, and transported to a laboratory for analysis.	Equipment blank(s) will be taken at a rate of 5 percent of total number of samples collected. This blank will be analyzed for all laboratory analyses requested where applicable for environmental samples collected at the site.
Field Duplicate	Water, Sediment, and Fish Tissue	A field duplicate is a sample collected at the same sampling location and at the same sampling event as the other samples. The field duplicate is designed to check repeatability or precision of data in the laboratory. Fish tissue sample duplicates will be prepared by the laboratory following homogenization, provided sufficient tissue is available.	A total of 5 percent of all water samples will be field duplicates. Both duplicates (e.g., the sample and the duplicate) will be analyzed for the same parameters in the laboratory. For sediment, three replicate samples will be collected at each site, so field duplication is not necessary.

4.5 Decontamination Procedures

4.5.1 Introduction

Field decontamination procedures are outlined below. Only the sediment coring devices and sampling utensils used for sediment collection will require decontamination because as all the water samples will be collected directly from the receiving water sea surface into the sample containers, with no sampling equipment being used. Leachate and other influent source samples will be collected by AWWU with composite tubing and bottle cleaning and decontamination following their standard procedures. For benthic sampling, gear will be thoroughly cleaned with site water, or filtered site water in the case of the sieves, prior to sampling at the next station, as there are no concerns of chemical contamination.

4.5.2 Stainless-Steel or Metal Sampling Equipment

Decontamination of re-usable stainless steel or metal field sampling equipment used for the collection of samples for chemical analyses will follow this procedure. Equipment will be decontaminated prior to use in the field and between replicate collections within a site and between sites as described by the following:

1. Wash thoroughly with ambient site water and clean with a brush as necessary to remove particulate matter, debris, or surface film. debris.
2. Wash thoroughly with laboratory detergent (Alconox® detergent or similar).
3. Rinse with clean potable water.
4. Rinse thoroughly (triple-rinse) with metals-free deionized water.
5. Wrap equipment completely within a plastic bag to prevent contamination during storage and/or transport to the field.

When not in use, decontaminated equipment will be stored in an environment free of hydrocarbons (vessel exhaust) or metallic surfaces to prevent contamination. Any sampling equipment suspected of contamination will be decontaminated again before use.

Used equipment rinsate solutions that exhibit any suspect chemical contaminants (e.g., exhibit an oil sheen) will be collected for proper onshore disposal. Otherwise, all residual sediment remaining after sampling activities and all equipment rinsate solutions (including seawater mixed with Alconox or Liquinox® detergent) will be disposed of as close as possible to the location from which they were derived (i.e., in the vicinity of the sampling station once sampling is complete). Both Alconox and Liquinox are water soluble, biodegradable detergents approved by the U.S. Department of Agriculture.

4.6 Sample Custody

4.6.1 Field Logs

Data for each attempted field sample collection will be recorded on individual project-customized field logs that will include, at a minimum, date and time of collection, sampling personnel and platform, weather and sea state information, station and navigational information, gear type in use, measured water depth if applicable, target sampling depth if applicable, tide stage/water level, penetration depth of corer, and comments concerning sampling anomalies or deviations from this QAPP. These logs will serve to document failed sampling attempts as well as successful sample retrievals; one log will be completed for each sampling site. The log forms will also be used to document the type of substrate encountered along with its color, density, consistency, odor, and the presence of organisms, vegetation, fines, or debris, oil sheen or visible contamination, and/or other distinguishing characteristics. Photographs of the sampling will also be documented on the field logs and/or using a project-customized electronic field logging software application amenable to cataloging photographs. At the completion of each field survey, the lead scientist will review all associated field logs and sign off as to their accuracy and completeness.

4.6.2 Sample Labels

Pre-printed project-customized sample labels will be waterproof and will be placed on the outside of each sample container; benthic samples will also contain an internal cotton rag paper label marked with indelible pencil or ink as is customary. Hand-entered label information will be in indelible ink (e.g., waterproof Sharpie®). Each label at minimum will provide the following information:

- Project name
- Station identification
- Sample identification number (“SAMPID”)
- Sample depth (i.e., intertidal or subtidal)
- Date and time of sample collection

- Analyses to be performed
- Preservation method (if appropriate)
- Number of containers
- Collector's initials

4.6.3 Sample Custody

4.6.3.1 Field Operations

COC protocols include COC activities in the field as well as during shipment of the samples to the offsite laboratories. This includes the use of project-customized COC forms that are used to identify the samples, the sample custodians, and the dates and modes of transfer during transport to the analytical laboratory.

The sampling team that collects the samples retains custody of the samples in the field. The samples remain in the possession of and in view of a member of the sampling team until they are placed in a designated secure area. Samples will be considered to be "in custody" if they are:

- In the custodian's possession or view,
- In a secured place (locked) with restricted access, or
- In a secure container.

Standard COC procedures will be used for all samples collected, transferred, and analyzed as part of this project. Except for the shipping carrier (e.g., Federal Express), each person who has custody of the samples will sign the COC form, whether relinquishing or receiving the samples, and will ensure samples are shipped or stored properly and securely.

Standard information on COC forms includes:

- Sample identification (SAMPID and location)
- Sample collection date and time
- Sample matrix
- Analyses to be performed
- Container types and numbers
- Preservation method
- Dates and times of transfer
- Name of shipping company
- Names of persons with custody

The signed COC forms will be placed in a sealed plastic bag that will be taped to the lid of the cooler containing the samples for shipment by a commercial carrier. Coolers will be taped securely shut using strapping tape and sealed with a signed and dated custody seal prior to shipping with a carrier; these custody seals are covered with clear tape and affixed in such a way that the seal must be broken when opening the cooler so that any tampering will be visibly evident. The shipping and tracking information from the carrier are used in lieu of a signature on the COC while the carrier holds custody of the samples. Sample receipt at the laboratory will be fully documented, and COC records will be included in the final data reports prepared by the analytical laboratory.

4.6.3.2 Laboratory Operations

Detailed laboratory COC procedures and related documentation, including sample receipt, storage, and tracking are summarized in the laboratory's Quality Assurance Plan (QAP) that will be reviewed by the Project QA Officer for compliance with project requirements before commencement of the field effort.

4.6.4 Sample Handling

All samples collected for the program will be collected following standard procedures as described in Section 3 of this document, placed in the appropriate pre-labeled containers during collection activities, stored at the appropriate temperature, and shipped or delivered under COC procedures to the analytical laboratory with sufficient time to allow analysis within holding time. Holding time is the maximum allowable time between sample collection and analysis and/or extraction, based on the method, analyte of interest, and stability factors, and preservative used (if any); allowable holding times are also provided in Table 4-7 through 4-9 (provided in corresponding sections below) for water, sediment, and tissue matrices, respectively.

Sample preservatives may be either included in the sample container by the laboratory or added to the sample immediately after collection, as is often the case of direct surface water samples. All samples will be placed in coolers with gel ice immediately following collection.

Samples will be shipped to the laboratory within a reasonable amount of time of being collected, given holding times and shipping requirements, to avoid potential delays over weekends or that may occur due to transportation anomalies. Procedures for sample shipment are as follows:

- Bubble wrap or other similar material will be placed on the bottom of the cooler. Samples will be placed on top of the bubble wrap.
- Glass bottles will be wrapped in bubble wrap or placed in plastic sleeves to prevent breakage. Groups of plastic bottles will be placed in clear, large Ziploc® bags and sealed.
- Sample bottles and packing material will be inserted, where appropriate, to ensure that the bottles will not move during shipment. A temperature control bottle will also be placed in the cooler to be used by the laboratory to check sample temperature upon receipt.
- Remaining space in the cooler will be filled with blue ice/gel ice packets in such a way to ensure that the entire cooler is chilled and will maintain a temperature of <6 degrees Celsius (°C) during transport.
- Completed and signed COC will be placed in a Ziploc® bag, which will be sealed and taped to the inside lid of the appropriate cooler.
- For coolers without hinges, two signed custody seals will be placed on the cooler, one on right side of the front of the cooler and one on the left side of the back of the cooler. For coolers with hinged lids, one custody seal will be placed on the front side of the cooler. Custody seals will be placed so that the seal must be broken when opening the cooler, and they will be covered with clear plastic tape.
- Coolers will be wrapped with strapping tape all around the cooler in two locations to securely close cooler lids.
- A shipping label will be placed on the top or front of the cooler and covered with clear plastic tape.

Coolers will be packed in such a way as to minimize the time that sample containers are not being chilled. Sample transportation will comply with U.S. Department of Transportation or other applicable requirements as appropriate.

Upon receipt, the laboratory custody personnel will conduct the following checks:

- Coolers will be checked for damage or leakage.
- Custody seals will be inspected to verify that they have not been broken.
- Once open, the temperature of the temperature control blank will be checked to verify that the samples were kept at or below 4°C. This information will be recorded by the laboratory and noted in the case narrative.
- Sample containers will be compared to the information on the COC to ensure that all containers are accounted for and will be inspected for breakage. If sample containers are missing or broken, the laboratory will notify the Field Team Leader (FTL) immediately.

- Information on missing or broken sample containers will be noted on the COC.
- Where appropriate, the pH of the preserved aqueous samples will be confirmed by the laboratory upon receipt.
- The date and time of sample receipt by the laboratory will be noted on the COC.
- Once received at the laboratory, the laboratory accepts responsibility for proper storage, tracking, analysis, and disposal of the samples.

4.6.4.1 Water Quality Samples

Water samples will be collected directly into pre-cleaned and properly labeled sample containers as noted in Section 3. Samples will be chilled on gel ice during sampling activities until they can be transported to KEI's onshore facility, where they will be maintained at acceptable temperatures until shipment under COC procedures to the laboratory. Holding times, preservation, minimum sample volumes, and container types required for each analytical parameter and method are presented in Table 4-7. Once at the laboratory, samples will be stored at the appropriate temperature until extraction and/or analysis.

Table 4-7. Water Methods, Holding Time, Preservative, Sample Size, and Container Type

Parameter	Analytical Method	Holding Time	Temperature/ Preservative	Minimum Sample Size (ml or L)	Container Number and Type
Cyanide	SW-846/9016	14 days	≤6°C, NaOH	250 ml	One 250-ml HDPE
Metals	200.8 (all but Mercury)	6 months	≤6°C, HNO_3	1 L	One 1-L HDPE
	1634E (Mercury only)	90 days	≤6°C, HCl	125 ml	One 125-ml FLPE
Dioxin	EPA 1613B	1 year	≤6°C	1 L	Two 1-L amber glass with Teflon-lined lid
PCBs	EPA 608.3	1 year	≤6°C	1 L	Two 1-L amber glass with Teflon-lined lid
Pesticides	EPA 608.3 (OC Pesticides)/ALS SOP (OP Pesticides)	7 days pre-extraction; 40 days post-extraction	≤6°C	1 L	Two 1-L amber glass with Teflon-lined lid
SVOCs	EPA 625.1	7 days pre-extraction; 40 days post-extraction	≤6°C	1 L	Two 1-L amber glass with Teflon-lined lid
VOCs	EPA 624.1	14 days	≤6°C, HCl	60 ml	Three 40-ml with Teflon-lined septa
Toxicity	Purple Urchin WET EPA/600/R-95/136	36 hours	≤6°C	1 gallon	One 1-gallon cubitainer

FLPE = fluorinated HDPE; L= liters.

4.6.4.2 Sediment Samples

Sediment samples will be collected from the sampling equipment into pre-cleaned and properly labeled sample containers as noted in Section 3.4.4. Samples will be chilled on gel ice during sampling activities until they can be transported to KEI's facility, where they will be maintained at acceptable temperatures for shipment. Holding times, preservation, minimum sample volumes, and container types required for each

analytical parameter and method are presented in Table 4-8. Once at the laboratory, the samples will be stored and frozen at appropriate temperatures until extraction and/or analysis.

Table 4-8. Sediment Methods, Holding Time, Preservative, Sample Size, and Container Type

Parameter	Analytical Method	Holding Time	Temperature/ Preservative	Minimum Sample Size (g)	Container Number and Type
Particle Grain Size	ASTM D422M	6 months	≤6°C	100 to 200 g	Ziplock bag (1 gallon)
TOC	ASTM D4129-05	14 days	≤6°C	125 g	One 16-oz (~500-ml) glass with Teflon-lined lid
Total solids	EPA 160.3 Mod	14 days	≤6°C	125 g	
TVS	SM 2540G	14 days	≤6°C	125 g	
Metals	EPA 6020A (Mercury 1631E)	6 months except mercury (28 days)	≤6°C	50 g	One 16-oz (~500-ml) glass with Teflon-lined lid
PCBs	EPA 8082A	14 days pre-extraction; 40 days post-extraction	≤6°C	150 g	One 8-oz (~250-ml) glass with Teflon-lined lid
Pesticides	EPA 8081B (OC Pesticides)/ALS SOP (OP Pesticides)	14 days pre-extraction; 40 days post-extraction	≤6°C	150 g	One 8-oz (~250-ml) glass with Teflon-lined lid
SVOCs	EPA 8270D	14 days pre-extraction; 40 days post-extraction	≤6°C	150 g	One 8-oz (~250-ml) glass with Teflon-lined lid
Dioxin	EPA 8290	30 days pre-extraction; 45 days post-extraction	≤6°C	150 g	One 4-oz (~125 ml) glass with Teflon-lined lid
VOCs	EPA 8260C	14 days	≤6°C, methanol	25 g	One 2-oz (~60-ml) glass with Teflon-lined lid

g = grams; oz = ounce.

4.6.4.3 Benthic Invertebrate Samples

Benthic infauna samples will be placed in clean pre-labeled wide-mouth HDPE or glass containers after sieving, and an internal benthic label will be included in each sample jar, as described in Section 3.5.4. The sample containers will be stored in coolers until the field crew transits to the KEI's facility in Anchorage, where they will be stored in a secure area for processing.

After sample transfer from formalin to 70 percent ethanol and sorting (removal of organisms from the sediment), any organisms being sent for taxonomic identification will be shipped in alcohol following applicable COC protocols and shipping procedures as described above. No temperature preservation is necessary, but all samples will be packed securely to minimize breakage and maintain integrity prior to shipment under COC protocols.

4.6.4.4 Fish Tissue Samples

Aluminum-wrapped fish tissue samples will be placed in clean pre-labeled plastic bags, double bagged, and held on gel ice in the field as described in Section 3.7.4. Samples will be frozen at KEI's facility prior to shipment to the laboratory to maintain tissue integrity. Holding times, preservation, minimum sample

volumes, and container types required for each analytical parameter and method are presented in Table 4-9. Shipping of fish tissues for analysis will follow all COC protocols and shipping procedures as outlined above. Once at the laboratory, the samples will be stored and frozen at -18ºC until analysis within holding times as prescribed by method.

Table 4-9. Tissue Methods, Holding Time, Preservative, Sample Size, and Container Type

Parameter	Analytical Method	Holding Time	Temperature/ Preservative	Minimum Sample Size (g)	Container Number and Type
Total Solids	EPA 160.3 Mod	14 days	Frozen (-18°C)	250 g	Aluminum-foil wrapped in plastic bag
Metals	EPA 6020A (Mercury 1631E)	6 months except Mercury (28 days)	Frozen (-18°C)	10 g	One 8-oz (~250-ml) glass with Teflon-lined lid
Dioxin	EPA 8290	30 days pre-extraction; 45 days post-extraction	Frozen (-18°C)	25 g	One 8-oz (~250-ml) glass with Teflon-lined lid
PCBs	EPA 8082A	14 days pre-extraction; 40 days post-extraction	Frozen (-18°C)	20 g	One 8-oz (~250-ml) glass with Teflon-lined lid
Pesticides	EPA 8081B (OC Pesticides)/ALS SOP (OP Pesticides)	14 days pre-extraction; 40 days post-extraction	Frozen (-18°C)	40 g	One 8-oz (~250-ml) glass with Teflon-lined lid
SVOCs	EPA 8270D	14 days pre-extraction; 40 days post-extraction	Frozen (-18°C)	20 g	One 8-oz (~250-ml) glass with Teflon-lined lid

4.7 Calibration and Preventive Maintenance

4.7.1 Calibration

Laboratory equipment must operate satisfactorily within specified operating limits before it can be expected to produce reliable and usable data for a project. Documentation concerning the calibration of laboratory equipment should include instrument type, calibration frequency, reference standards used, calibration acceptance criteria, and calibration documentation procedures. Calibration applies to laboratory instruments including balances, refrigerators, and ovens. Details about individual method calibration requirements and performance criteria are included in ALS's laboratory QAM.

4.7.2 Preventive Maintenance

4.7.3 Laboratory

Designated laboratory personnel will be trained in routine maintenance procedures for all major instrumentation. Either trained staff or trained service engineers/technicians employed by the instrument manufacturer will perform any necessary repairs. The laboratory will have multiple instruments that will serve as backup to minimize the potential for down time. All maintenance will be documented and kept in permanent logs. These logs will be available for review by auditing personnel. Additional details about preventive maintenance for laboratory instruments are included in the laboratories QAM, which are included in Appendix A.

4.8 Field Training and Recordkeeping

4.8.1 Training

Field personnel will be trained in proper sample collection techniques, all sample custody procedures, and project-specific procedures as outlined in this QAPP. New field staff, if any, will receive comprehensive training before participating in field activities. Further, prior to each monitoring event, the FTL will conduct a training session with all staff to ensure that all project procedures are being followed. Documentation of each training session will be signed by all attending personnel, and records will be maintained at Jacobs and KEI offices in Anchorage.

4.8.2 Recordkeeping

Field personnel will maintain records of field operations, sampling, and measurement in a project-specific loose-leaf notebook containing customized field logs printed on Rite-in-the Rain® or similar waterproof paper that are tailored specifically to this project. Entries in the notebook will be made with indelible ink, and each type of field log will be sequentially numbered. Documentation in the field notebooks will facilitate sample identification and tracking, COC, and eventual uploading of field data to the database, and may include the following:

- Project title
- Type of sampling
- Location
- Date and time of sampling collection
- Types of gear used for sample collection
- Names of field crew
- Weather conditions and sea state encountered during field activity
- Navigational coordinates (DGPS) of sampling location
- Water depths, sample collection depths, equipment penetration depths, as appropriate
- Sample description (such as color, odor, visual assessment of turbidity or disturbance, visible organisms)
- Other field measurements, if any
- Calibration results
- Identification of conditions that might affect the representativeness of a sample (such as recent storm event, rough seas, heavy swells)
- Notations regarding any deviations from this QAPP
- Signature of primary note taker and that of the Field Lead reviewer

If entries in the field notebooks need to be corrected or changed, corrections will be made by crossing out mistakes with a single line, writing the corrections, and initialing and dating the entry. The use of correction fluid or obliteration of prior entries is not permitted. In addition to the field notebooks, COC forms will also be used to document field efforts. Any deviations or modifications to the field procedures specified in the QAPP and/or EPA methods will be fully documented on the field logs.

4.9 Audits

Field and laboratory performance will be audited to verify documentation and implementation of the QAPP and correction of identified deficiencies, as well as to identify any non-conformances.

4.9.1 Field Audits

Assessment activities may include surveillance, inspections, peer review, management system review, readiness review, technical systems audit, performance evaluation, data quality assessment, etc. The Project QA/QC Officer and Studies Manager will be responsible for initiating performance audits and overseeing audit finding implementation.

4.9.2 Program Team Audits

Performance audits conducted by the Program Team are used to quantitatively assess the accuracy of analytical data through the use of performance evaluation and blind check samples. Laboratory performance will be audited by the Project QA/QC Officer or designee.

4.9.3 Laboratory Performance and Systems Audits

The analytical laboratory will conduct both internal and external QC checks. External QC checks include participation in EPA's certification and performance evaluation programs. The results of performance evaluation samples will be made available to the Project QA/QC Officer and Studies Manager. Internal QC checks (duplicates, method blanks, and matrix spiked samples) will be performed in accordance with the approved methods.

Laboratory systems will be audited as required. Contracted laboratories have submitted their QAMs, which are included in Appendix A. Laboratory QAPs will be provided on request. If any problems are noted during data evaluation and data use, specific corrective actions will be implemented on a case-by-case basis. An additional systems audit may be requested by the Project QA/QC Officer and Studies Manager, if warranted.

Depending on the project objectives, the laboratory may be required to perform the following:

- Monthly project review of 10 percent of all projects done by the QA department
- Audits performed by the Laboratory QA/QC Officer at a frequency greater than specified in the laboratory QAP
- Special audits by the corporate management when a problem is suspected

4.10 Corrective Action

4.10.1 Field Corrective Actions

The Project QA/QC Officer and Studies Manager are responsible for initiating corrective actions. Corrective action steps include problem identification, investigation responsibility assignment, investigation, action to eliminate the problem, increased monitoring of the effectiveness of the corrective action, and verification that the problem has been eliminated.

Documentation of the problem is important to the overall management of the study. A corrective action request form for problems associated with sample collection is completed by the person discovering the QA problem. This form identifies the problem, establishes possible causes, and designates the person responsible for action. The responsible person will be either the Project QA/QC Officer or the Studies Manager.

The Correction Action Request Form (Figure 4-1) includes a description of the corrective action planned and has space for follow-up. The Studies Manager and Project QA/QC Officer verifies that the initial action has been taken and appears to be effective and, at an appropriate later date, checks to see if the problem has been resolved fully. The Studies Manager and Project QA/QC Officer receives a copy of all corrective action request forms and enters them into the corrective action log. This permanent record aids the Studies Manager and Project QA/QC Officer in follow-up and assists in resolving the QA problems.

Examples of corrective action include, but are not limited to, correcting COC forms, analysis reruns (if holding time criteria permit), re-calibration with fresh standards, identification of sources of blank

contamination, or additional training in sampling and analysis. Additional approaches may include the following:

- Re-sampling and re-analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting the data and acknowledging the level of uncertainty or inaccuracy by flagging the validated data and providing an explanation for the qualification

4.10.2 Laboratory Corrective Actions

The laboratory supervisors review the data generated to verify that all QC samples have been run as specified in the protocol. Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy established for laboratory samples.
- Blanks contain contaminants at concentrations above the levels specified in the laboratory QAPP for any target compound.
- Undesirable trends are detected in matrix spike recoveries or relative percent difference between matrix spike duplicates.
- There are unusual changes in detection limits.
- Deficiencies are detected by the laboratory QA director during internal or external audits, or from the results of performance evaluation samples.

If nonconformances in analytical methodologies, QC sample results, etc., are identified by the bench analyst, corrective actions are implemented immediately. Corrective action procedures are handled initially at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors and checks the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. The analyst immediately notifies their supervisor of the problem that is identified and the investigation being made. If the problem persists or cannot be identified, the matter must be referred to the laboratory supervisor and Laboratory QA/QC Officer for further investigation. Once resolved, full documentation of the corrective action procedure must be filed with the laboratory supervisor, and the Laboratory QA/QC Officer must be provided a corrective action memorandum for inclusion into the project file if data are affected.

Corrective actions may include, but are not limited to the following:

- Re-analyzing suspect samples
- Re-sampling and analyzing new samples
- Evaluating and amending sampling and/or analytical procedures
- Accepting data with an acknowledged level of uncertainty
- Re-calibrating analytical instruments
- Qualifying or rejecting the data

Following the implementation of the required corrective action measures, data that are deemed unacceptable may not be accepted by the Project QA/QC Officer and Studies Manager, and follow-up corrective actions may be explored. Details of laboratory corrective actions will be provided in the laboratory QAP on request.

Figure 4-1. Corrective Action Request Form

Originator: _____ Date: _____

Person responsible for replying: _____

Description of problem and when identified: _____

_____

Sequence of Corrective Action (CA): (If a responsible person is not identified, submit this form directly to the Studies Manager and Project QA/QC Officer)

State date, person, and action planned:

_____

_____

_____

_____

_____

CA initially approved by: _____ Date: _____

Follow-up date: _____

Final CA approval by: _____ Date: _____

Information copies to:

Responsible person: _____

Studies Manager: _____

Project QA/QC Officer: _____

4.11 Data Management and Validation

The goal of this AWPCF 301(h) waiver and NPDES permit renewal data collections program is to provide complete and accurate data of known quality. To meet this goal, procedures for ensuring the accuracy of the field and analytical data must be followed.

4.11.1 Data Management

Microsoft® *Access*™ database management software will be used to manage the daily project database. A project-specific sample tracking program (STP) will be used to manage the flow of the information from the field sampling team(s) through the analytical laboratory and ultimately to the internal/external clients. STP is an application that may be used to produce sample container labels and electronic COC records. The STP will be programmed to reduce field entry errors with the assistance of an internal validation application that inhibits the operator from entering incorrect information.

Laboratories will provide data in electronic format to the database supervisor. The electronic deliverable from the laboratory will be a comma delimited ASCII file that contains all the information required for completing the sample preservation information and analytical result files when combined with the information in the STP.

4.11.2 Data Reduction

Field documentation, sample data, instrument calibrations, and QC data (field and laboratory) will be reviewed and validated by the Project QA/QC Officer before being included in the project files. QC checks also will be reviewed by the Studies Manager, who will be responsible for summarizing these data. The pH, temperature, salinity, depth, dissolved oxygen, and conductivity readings are recorded by the FTL and reviewed by the Project QA/QC Officer before being included in the project files in the raw form.

Should erroneous or missing data appear in the project documentation, the Project QA/QC Officer will cross check this information with the FTL. If the FTL or their project notes cannot verify the data, the Project QA/QC Officer will be called on to make a final decision as to the usability of the data in question based on discussions with the entire sampling team, knowledge of any problems that were incurred during that particular sampling event, and review of collateral data (QC checks) that may indicate specific problems with field instrumentation. If the data cannot be verified, then the data will be flagged as rejected and not used.

4.11.3 Data Validation

The purpose of the data quality evaluation process is to assess the effect of the overall analytical process on data usability. Two major data evaluation categories are laboratory performance and matrix interferences. The laboratory performance evaluation determines compliance with the specific analytical method requirements. Evaluation of matrix interferences is more subtle and involves the review of multiple data quality control (QC) areas, including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results. The data review and validation process is as follows:

- Prior to release by the laboratory, all analytical data are carefully reviewed to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the QC data are reduced, and the resulting data are reviewed to ascertain compliance with the laboratory-defined limits for accuracy and precision. Any non-conforming data are discussed in the data package cover letter and case narrative.
- Following submittal by the analytical laboratory, water quality and sediment chemistry data are validated by the project chemist based on compliance with the analytical method requirements, and reviewed to assess the accuracy, precision, and completeness of the data following procedures modeled on the *National Functional Guidelines for Organic Data Review* (EPA, 1999) and *National Functional Guidelines for Inorganic Data Review* (EPA, 2002).

- QA/QC summary forms and data reports are reviewed and included (when applicable to the method) for the following areas: holding time compliance, calibration verification, blank results, matrix spike precision and accuracy, method accuracy as demonstrated by laboratory control samples (LCSs), field duplicate results, surrogate recoveries, internal standard performance, and interference checks. Data are also evaluated to identify potential data limitations and/or uncertainties in the analytical results.

This process is independent of the laboratory's checks and focuses on the usability of the data to support the project data interpretation and decision-making processes. A data review worksheet is completed for each data package, and non-conformance data are documented.

Data that are not within the acceptable limits are appended with a qualifying flag (single- or double-letter abbreviation). Although the qualifying flags originate during the database query process, they are included in the final data summary tables so that the data will not be used indiscriminately. The following flags are used in the process:

- **U:** Undetected. Analyte was analyzed for but not detected above the MDL.
- **UJ:** Detection limit estimated. Analyte was analyzed for, and qualified as not detected. The result is estimated.
- **J:** Estimated. Analyte was present, but the reported value may not be accurate or precise.
- **R:** Rejected. Data are unusable. (Note: Analyte/compound may or may not be present.)

Numerical sample results that are greater than the MDL but less than the laboratory RL are qualified with a "J" for estimated as required by the EPA *Functional Guidelines for Evaluating Data Quality (1994a)*.

The entire database is queried for frequency of detection in blanks and samples, detailed listing of blank detects, matrix spike/matrix spike duplicate (MS/MSD) results, field duplicate precision, surrogate recoveries, preparation, and analysis dates pertaining to holding times. The queries are then manipulated to calculate necessary statistics for evaluation of the data.

Once the data review and validation process is completed, the entire dataset is reviewed for chemical compound frequencies of detection, dilution factors that might affect data usability, and patterns of target compound distribution. The dataset is also evaluated to identify potential data limitations and/or uncertainties in the analytical results. A comprehensive summary of data validation results and compliance with project DQOs is prepared for review by the Project QA/QC Officer and it will be included with the studies report.

4.11.3.1 Procedures Used to Assess Data Precision, Accuracy, Completeness, Representativeness, and Comparability

QC Measures

The following QC measures are used to assess data precision and accuracy:

- Method blanks
- Matrix spikes or lab control spikes and duplicates
- Surrogate spike recoveries

Method Blanks

A method blank is a sample of analyte-free water that is treated as a sample in that it undergoes the same analytical process as the corresponding field samples. Method blanks are used to monitor laboratory performance and contamination introduced during the analytical procedure. Typically, one method blank is required per 10 or 20 samples (depending on the analytical method) or one per batch, whichever is more frequent.

Matrix Spikes

For inorganic analyses, a single sample is split, and one portion is spiked with a known amount of reference material. For organic analyses, three aliquots of a single sample are analyzed: one native and two spiked with matrix spike compounds. Unlike the surrogate spike compounds, matrix spike compounds are found on the method target compound list. Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. The duplicate spike results are compared to evaluate precision. The matrix spike compounds and method target acceptance ranges are summarized for each analytical method. Typically, one matrix spike (inorganic) or MS/MSD sample (organic) is analyzed for every 20 samples of the same matrix. In some cases, a laboratory control spike may be substituted for organic methods, especially in the case where inadequate sample volumes exist, precluding the use of matrix spikes.

Surrogate Spikes Recoveries

This QC measure is only applicable to organic analyses. Surrogate compounds are the structural homologs of target compounds, often with deuterium substituted for hydrogen, and are, therefore, expected to behave in a similar manner during the analysis. Surrogate spike recoveries are used to monitor both laboratory performance and matrix interferences. Surrogate spike recoveries from field and laboratory blanks are used to evaluate laboratory performance because the blanks represent an "ideal" sample matrix. Surrogate spike recoveries for field samples are used to evaluate the potential for matrix interferences. For field samples, when the surrogate spike recoveries fall outside the method target acceptance windows, sample analysis will be reviewed by the laboratory QC officer and appropriate action taken as dictated by the QAM that may include re-analysis of samples if sufficient material is available. If the surrogate spike is still outside the acceptance window for the re-analysis, then the sample results are qualified as affected by matrix interferences.

4.11.3.2 Formulas for Calculating Accuracy, Precision, and Completeness

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under the same conditions. Precision will be estimated from analytical data and cannot be measured directly. The precision of a duplicate determination can be expressed as the relative percent difference (RPD), as calculated from the equation:

$$RPD = \{I X_1 - X_2 I / (X_1 + X_2)\} \times 200$$

Where:

X_1 and X_2 are the duplicate values

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is estimated through the use of known reference materials or matrix spikes. Accuracy is calculated from analytical data and is not measured directly. Spiking of reference materials into an actual sample matrix is the preferred technique because it provides a measure of the matrix effects on the analytical accuracy. Accuracy, defined as percent recovery (P), is calculated by the following equation:

$$P = \{(SSR - SR)/SA] \times 100\}$$

Where:

SSR is the spiked sample result, SR is the sample result (native), and SA is the spike added

Completeness is defined as the percentage of measurements that are judged to be valid compared to the total number of measurements made. Completeness is calculated using the formula:

$$\text{Completeness} = \text{Valid Measurements/Total Measurements} \frac{\text{Valid Measurements}}{\text{Total Measurements}} = 100$$

A goal of 95 percent usable data is established for the AWPCF 301(h) waiver and NPDES permit data collections program, and the percentage of data that are determined to be valid for each monitoring event is presented in the Data Quality Evaluation that is included with each data report.

4.11.3.3 Procedures Used to Document Data Representativeness and Comparability

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent characteristic environmental condition. Representativeness is a subjective parameter and is used to evaluate the efficacy of the sampling plan design. Under the AWPCF 301(h) waiver and NPDES permit data collections program, representativeness is demonstrated by providing full descriptions of the sampling techniques and the rationale used for selecting sampling locations as provided in Section 3. Any deviation from the pre-approved monitoring locations will be documented in the report.

Comparability is another qualitative measure designed to express the confidence with which one data set may be compared to another. The following factors affect comparability: sample collection and handling techniques, sample matrix type, and analytical methods, including MDLs, RLs, and data reporting. Comparability is limited by the other PARCC parameters because data sets can be compared with confidence only when precision and accuracy are known. Data from one monitoring event to another can be compared when the same EPA-approved methods are used and if the data package deliverables are similar. Sampling procedures and analytical methods will be used consistently at all AWPCF data collection events as outlined in this QAPP.

4.12 QA Reports

The purpose of QA report is to document implementation of this QAPP. This report will include assessments of measurement data accuracy, precision, and completeness; the results of performance and system audits; and identification of any significant QA problems and recommended solutions. The validated laboratory data reports will include a QA/QC data package and a case narrative detailing any non-conformances in the QA/QC data.

A QA report will be attached as an appendix to the study report and may include the following:

- Data quality assessment in terms of precision, accuracy, representativeness, completeness, and comparability, and the MDLs
- The degree to which DQOs were met
- Limitations of the measurement data; usability of the data
- Applicability of the data to site conditions
- Laboratory QC activities, including a summary of planned versus actual laboratory QC activities, explanations for deviations, and an evaluation of data quality for each analysis for each media
- Field QC activities, including a summary of planned versus actual field QC activities, explanations for deviations, and an evaluation of the data quality of field QC samples/activities and estimated impact on sample data
- Data presentation and evaluation, including an assessment of sampling and analysis techniques, data quality for each analysis and each matrix, and data usability

Reports will include copies of the field data sheets, COCs, validated laboratory reports, and QA/QC summaries.

5. Study Documentation

A combined data report will be generated after the 2022 sampling events. The data report will be formatted as a stand-alone technical report to synthesize data generated by the data collections program. The data report will be included as an appendix to the AWPCF 301(h) waiver and NPDES permit renewal application supplement. The following information will be included:

- Summary of field observations
- Summary of analytical and biological results
- Field and laboratory QA/QC summaries
- Summary of validated laboratory data packages
- Copies of field data sheets and COC forms

6. Works Cited

Anchorage Water and Wastewater Utilities (AWWU). 2022. *Laboratory Services Quality Assurance/ Quality Control Plan*. Anchorage Water & Wastewater Utility, Treatment Division, Water Quality Section, Asplund Laboratory. Alaska Laboratory #AK00017.

CH2M HILL. 1998. Renewal Application for AWPCF NPDES Permit.

CH2M HILL. 1999. AWWU Application for Site Specific Water Quality Criteria (SSWQC) to the Alaska Department of Environmental Conservation (ADEC) for a Limited Area of the Upper Cook Inlet in the Vicinity of Point Woronzof.

CH2M HILL. 2004. AWWU Application to the EPA for Renewal of the NPDES Permit and 301(h) Waiver.

Kinnetics Laboratories Inc. (KLI) 1987a, 1987b, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, and 2021. Annual monitoring program reports produced by KEI and submitted to EPA by AWWU.

Kinnetics Laboratories Inc. (KLI) 2012. Monitoring Program Workplan and Quality Assurance Project Plan for the AWPCF NPDES Permit and 301(h) Waiver. Anchorage Water and Wastewater Utility, John M. Asplund Water Pollution Control Facility, NPDES Permit AK-002255-1.

National Oceanic and Atmospheric Administration [NOAA]. 2000. National Marine Fisheries Service letter to EPA about concurrence with EPA's Biological Evaluation and the EFH Assessment conclusions. June.

U.S. Environmental Protection Agency (EPA). 1986. *Bioaccumulation Monitoring Guidance: 4. Analytical Methods for U.S. EPA Priority Pollutants and 301(h) Pesticides in Tissues from Estuarine and Marine Organisms.* EPA, 68-01-6938.

U.S. Environmental Protection Agency (EPA). 1982. *Revised Section 301(h) Technical Support Document.*

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste*.

U.S. Environmental Protection Agency (EPA). 1987. *Quality Assurance/Quality Control (QA/QC) for 301(h) Monitoring Programs: Guidance on Field and laboratory Methods.* EPA 430/9-86-004. March.

U.S. Environmental Protection Agency (EPA). 1991. *Technical Support Document for Water Quality-based Toxics Control.* (EPA 502/2-90-001). March.

U.S. Environmental Protection Agency (EPA). 1993. *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA/600/4-90/027-F) 4th ed. August.

U.S. Environmental Protection Agency (EPA). 1994a. *Functional Guidelines for Evaluating Data*. February.

U.S. Environmental Protection Agency (EPA). 1994b. *Short-Term Methods for Estimating the Chronic Toxicity of Effluent and Receiving Waters to Marine and Estuarine Organisms* (EPA/600/4-91/003) 2nd ed. July.

U.S. Environmental Protection Agency (EPA). 1994c. *Amended Section 301(h) Technical Support Document.* (EPA 842-B-94-007). September.

U.S. Environmental Protection Agency (EPA). 1995. *Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*. EPA 821-R-95034. April.

U.S. Environmental Protection Agency (EPA). 1997. *Methods and Guidance for Analysis of Water*.

U.S. Environmental Protection Agency (EPA). 1999. *National Functional Guidelines for Organic Data Review.* October.

U.S. Environmental Protection Agency (EPA). 2000a. *Biological Assessment of Asplund WPCF NPDES Permit Renewal on Upper Cook Inlet*. April.

U.S. Environmental Protection Agency (EPA). 2000b. *Essential Fish Habitat Assessment of Asplund WPCF NPDES Permit Renewal on Upper Cook Inlet*.. June.

U.S. Environmental Protection Agency (EPA). 2000c. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (EPA 823-B-00-008). Volume 2: Risk Assessment and Fish Consumption Limits*. Third Edition. November.

U.S. Environmental Protection Agency (EPA). 2002. *National Functional Guidelines for Inorganic Data Review.* July.

U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (USACE). 1981. *Procedures for Handling and Chemical Analysis of Sediment and Water Samples*. Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material. Technical Report EPA/CE-81-1. May.

Appendix A
Laboratory Applicable Standard Operating Procedures
ALS Laboratory